Clinical Practice Guideline

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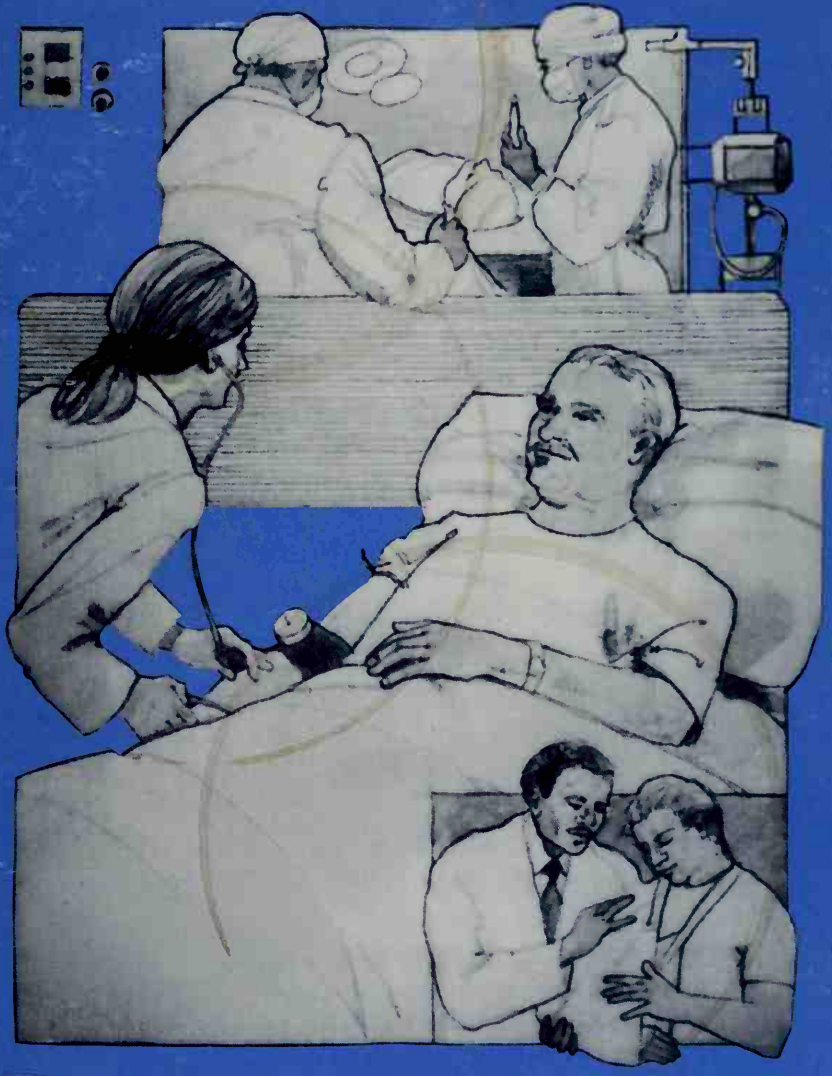
Acute Pain Management: Operative or Medical Procedures and Trauma

Acute Pain Management



U.S. Department of Health and Human Services
Public Health Service
Agency for Health Care Policy and Research

The Agency for Health Care Policy and Research (AHCPR) was established in December 1989 under Public Law 101-239 (Omnibus Budget Reconciliation Act of 1989) to enhance the quality, appropriateness, and effectiveness of health care services and access to these services. AHCPR carries out its mission through conduct and support of general health services research, including medical effectiveness research, facilitating development of clinical practice guidelines, and dissemination of research findings and guidelines to health care providers, policymakers, and the public.

The legislation also established within AHCPR the Office of the Forum for Quality and Effectiveness in Health Care (the Forum). The Forum has primary responsibility for facilitating the development, periodic review, and updating of clinical practice guidelines. The guidelines will assist practitioners in the prevention, diagnosis, treatment, and management of clinical conditions.

Other components of AHCPR include: the Center for Medical Effectiveness Research, which has principal responsibility for patient outcomes research and studies of variations in clinical practice; the Center for General Health Services Extramural Research, which supports research on primary care, the cost and financing of health care, and access to care for underserved and rural populations; the Center for General Health Services Intramural Research, which uses large data sets for policy research on national health care expenditures and utilization, hospital studies, and long-term care; the Center for Research Dissemination and Liaison, which produces and disseminates findings from AHCPR-supported research, including guidelines, and conducts research on dissemination methods; the Office of Health Technology Assessment, which responds to requests from Federal health programs for assessment of health care technologies; and the Office of Science and Data Development, which develops specialized data bases and enhances techniques for using existing data bases for patient outcomes research.

Guidelines are available in formats suitable for health care practitioners, the scientific community, educators, and consumers. AHCPR invites comments and suggestions from users for consideration in development and updating of future guidelines. Please send written comments to Director, Office of the Forum, Executive Office Center, Suite 401, 2101 East Jefferson Street, Rockville, MD 20852.

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February 1992

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Guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical conditions. This guideline was developed by an independent, multidisciplinary panel of private sector clinicians and other experts convened by the Agency for Health Care Policy and Research (AHCPR). The panel employed an explicit, science-based methodology and expert clinical judgment to develop specific statements on patient assessment and management for the clinical condition selected.

Extensive literature searches were conducted and critical reviews and syntheses were used to evaluate empirical evidence and significant outcomes. Peer review and field review were undertaken to evaluate the validity, reliability, and utility of the guideline in clinical practice. The panel's recommendations are primarily based on the published scientific literature. When the scientific literature was incomplete or inconsistent in a particular area, the recommendations reflect the professional judgment of panel members and consultants. In some instances, there was not unanimity of opinion.

The guideline reflects the state of knowledge, current at the time of publication, on effective and appropriate care. Given the inevitable changes in the state of scientific information and technology, periodic review, updating, and revision will be done.

We believe that the AHCPR-assisted clinical guideline development process will make positive contributions to the quality of care in the United States. We encourage practitioners and patients to use the information provided in this clinical practice guideline. The recommendations may not be appropriate for use in all circumstances. Decisions to adopt any particular recommendation must be made by the practitioner in light of available resources and circumstances presented by individual patients.

J. Jarrett Clinton, M.D.
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Foreword

Approximately 23.3 million operations were performed in 1989 in the United States, and most of these involved some form of pain management. Unfortunately, clinical surveys continue to indicate that routine orders for intramuscular injections of opioid "as needed"—the standard practice in many clinical settings—fail to relieve pain in about half of postoperative patients. Postoperative pain contributes to patient discomfort, longer recovery periods, and greater use of scarce health care resources and may compromise patient outcomes.

There is wide variation in the methods used to manage postoperative and other acute pain, ranging from no set strategy to a comprehensive team approach as advocated in this clinical practice guideline. This guideline sets forth procedures to minimize the incidence and severity of acute pain after surgical and medical procedures and pain associated with trauma in adults and children. It offers clinicians a coherent yet flexible approach to pain assessment and management for use in daily practice.

Although it is not practical or desirable to eliminate all postoperative and other acute pain, an aggressive approach to pain assessment and management can reduce such pain, increase patient comfort and satisfaction, and in some cases, contribute to improved patient outcomes and shorter hospital stays.

This clinical practice guideline was developed under the sponsorship of the Agency for Health Care Policy and Research (AHCPR), Public Health Service, U.S. Department of Health and Human Services. To develop the guideline, AHCPR convened an interdisciplinary expert panel made up of physicians, nurses, a pharmacist, a psychologist, a physical therapist, a patient/consumer, and an ethicist. The panel first undertook an extensive and interdisciplinary clinical review of current needs, therapeutic practices and principles, and emerging technologies for pain assessment and management. Second, the panel conducted a comprehensive review of the field to define the existing knowledge base and critically evaluate the assumptions and common wisdom in the field. Third, the panel initiated peer review of guideline drafts and field review with intended users in clinical sites. Comments from these reviews were assessed and used in developing the guideline.

This is the first edition of the *Clinical Practice Guideline for Acute Pain Management: Operative or Medical Procedures and Trauma*. Further editions will be produced as needed to reflect new research findings and experience with emerging technologies for pain assessment and relief.

Acknowledgments. The Acute Pain Management Guideline Panel expresses profound appreciation to the patients who helped us in the development of the consumer version of the guideline and to our numerous colleagues in many disciplines who made valuable contributions during the development of the guideline. We are especially grateful to Dr. Mitchell Max of the American Pain Society for his continuous and enthusiastic support and advice. Dr. Ada Jacox thanks her colleagues at The Johns Hopkins University for their thoughtful contributions and encouragement.

Numerous colleagues in the Departments of Surgery, Anesthesia, and Nursing at Massachusetts General Hospital provided informal yet valuable input as portions of the guideline were being written at that site. Dr. Daniel Carr's clinical colleagues in the Division of Pain Management of the Department of Anesthesia willingly increased their clinical load when the guideline development process became particularly time consuming. This extra workload fell particularly upon the shoulders of the Postoperative Pain Service, directed by Dr. Bucknam McPeek, and the Diagnostic and Therapeutic Nerve Blocking Unit, directed by Dr. Donald P. Todd. Dr. Richard J. Kitz, the Henry Isaiah Dorr Professor and Chairman of Anesthesiology, and Dr. George E. Battit, Vice-Chairman, provided constant encouragement for this project and facilitated it in many practical ways. Miss Evelyn Hall provided expert and dedicated administrative and secretarial assistance.

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Acute Pain Management: Operative or Medical Procedures and Trauma

Executive Summary

Clinical surveys continue to indicate that routine orders for intramuscular injections of opioid "as needed" fail to relieve pain in about half of postoperative patients. Recognition of the widespread inadequacy of pain management has prompted recent corrective efforts within multiple health care disciplines, including surgery, anesthesiology, and nursing, as well as pain management groups.

This *Clinical Practice Guideline for Acute Pain Management: Operative or Medical Procedures and Trauma* was commissioned by the Agency for Health Care Policy and Research (AHCPR). The guideline is designed to help clinicians, patients, and patients' families to understand the assessment and treatment of postoperative and other acute pain in both adults and children.

To develop the guideline, AHCPR convened an interdisciplinary panel of physicians, nurses, a pharmacist, a psychologist, a physical therapist, a patient/consumer, and an ethicist. The guideline development process included an extensive review of current needs, therapeutic practices and principles, and emerging technologies for postoperative pain control. All pertinent guidelines and standards were reviewed, opinions were obtained from external consultants, and testimony was received at an open forum held on November 20, 1990 in Washington, DC. An exhaustive literature search was conducted to define the knowledge base and critically evaluate the assumptions and common wisdom of the field. Although the review focused primarily on postoperative pain, literature on procedure-related and trauma pain was also considered. Drafts of the guideline were peer-reviewed and then tested in the field by intended users in various clinical sites.

The guideline has four major goals:

1. Reduce the incidence and severity of patients' acute postoperative or posttraumatic pain.

2. Educate patients about the need to communicate unrelieved pain so they can receive prompt evaluation and effective treatment.

3. Enhance patient comfort and satisfaction.

4. Contribute to fewer postoperative complications and, in some cases, shorter stays after surgical procedures.

Not all acute postoperative, procedural, or trauma-related pain can be eliminated, but several alternative approaches, when appropriately and attentively applied, prevent or relieve pain. The importance of effective pain management increases beyond patient satisfaction when additional benefits for the patient are realized, e.g., earlier mobilization, shortened hospital stay, and reduced costs.

This guideline addresses the care of patients with acute pain associated with operations, medical procedures, or trauma. All age groups are covered, from neonates to the elderly. It outlines the physiological basis of pain and summarizes clinical studies linking effective postoperative pain management with improved patient outcomes.

Because patients vary greatly in medical conditions and operations, responses to pain and interventions, and personal preferences, the guideline offers a flexible approach to management of acute pain that clinicians can adapt and use in daily practice.

The guideline emphasizes:

- A collaborative, interdisciplinary approach to pain control, including all members of the health care team and input from the patient and the patient's family, when appropriate;
- An individualized proactive pain control plan developed preoperatively by patients and practitioners (since pain is easier to prevent than to bring under control, once it has begun);
- Assessment and frequent reassessment of the patient's pain;
- Use of both drug and nondrug therapies to control and/or prevent pain;
- A formal, institutional approach to management of acute pain, with clear lines of responsibility.

The guideline includes strategies for overall pain control as well as site-specific pain control and addresses issues related to special groups such as children and the elderly. Additionally, it contains analgesic dosage tables for adults and children, sample pain assessment tools, examples of nondrug interventions, and pre- and postoperative pain management flow charts.

Guideline development is a dynamic process, and new therapies and technologies are always emerging. This is the first edition of the *Clinical Practice Guideline for Acute Pain Management.* Further editions will be prepared to reflect new research findings and experience with emerging technologies for pain assessment and relief.

Acute Pain Management: Operative or Medical Procedures and Trauma

Introduction

This guideline addresses the care of patients with acute pain after operation, medical procedures, or trauma. (Methods used to develop the guideline are in appendix A.) It outlines the physiological basis for pain and cites clinical studies linking effective postoperative pain management with improved patient outcomes. The guideline also describes practices that can minimize or eliminate acute pain. Rigid prescriptions for postoperative pain control are inappropriate because patients vary greatly in the severity of their preexisting pain, medical conditions, and pain experiences; the extensiveness of pathology and associated operations; responses to interventions; personal preferences; and the settings in which they receive care. Instead, this guideline offers clinicians a coherent yet flexible approach to pain assessment and management in daily practice. This guideline has four major goals:

1. Reduce the incidence and severity of patients' postoperative or posttraumatic pain.
2. Educate patients about the need to communicate unrelieved pain so they can receive prompt evaluation and effective treatment.
3. Enhance patient comfort and satisfaction.
4. Contribute to fewer postoperative complications and, in some cases, shorter stays after surgical procedures.

Need for Aggressive Postoperative Pain Control

Pain is an unpleasant sensory and emotional experience arising from actual or potential tissue damage or described in terms of such damage (International Association for the Study of Pain, 1979; Merskey, 1964). No matter how successful or how deftly conducted, operations produce tissue trauma and release potent mediators of inflammation and pain (Hargreaves and Dionne, 1991).

Pain is just one response to the trauma of surgery, however. In addition to the major stress of surgical trauma and pain, the substances released from injured tissue evoke "stress hormone" responses in the patient. Such responses promote breakdown of body tissue; increase metabolic rate, blood clotting, and water retention; impair immune function; and trigger a "fight or flight" alarm reaction with autonomic features (e.g., rapid pulse) and negative emotions (Dinarello, 1984; Egdahl, 1959; Kehlet, 1982; Kehlet, Brandt, and Rem, 1980). Pain itself may lead

to shallow breathing and cough suppression in an attempt to "splint" the injured site, followed by retained pulmonary secretions and pneumonia (Anscombe and Buxton, 1958; Hewlett and Branthwaite, 1975; Latimer, Dickman, Day, Gunn, and Schmidt, 1971; Marshall and Wyche, 1972; Sydow, 1989). Unrelieved pain also may delay the return of normal gastric and bowel function in the postoperative patient (Wattwil, 1989).

The physiological and psychosocial risks associated with untreated pain are greatest in frail patients with other illnesses such as heart or lung disease, those undergoing major surgical procedures such as aortic surgery, and the very young or very old. Because of advances in surgical and anesthetic techniques, it is now common for such patients to undergo operations once dismissed as prohibitively risky.

Approximately 23.3 million operations were performed in the United States in 1989 (Peebles and Schneidman, 1991), and most of these involved some form of pain management. Unfortunately, clinical surveys continue to show that routine orders for intramuscular injections of opioid "as needed" will leave more than half of postoperative patients with unrelieved pain due to undermedication (Marks and Sachar, 1973; Donovan, Dillon, and McGuire, 1987; Oden, 1989; Sriwatanakul, Weis, Alloza, Kelvie, Weintraub, and Lasagna, 1983). In the past, postoperative pain was thought to be inevitable, a harmless though intense discomfort that the patient had to tolerate. Unrelieved pain after surgery or trauma is often unhealthy; fortunately, it is preventable or controllable in an overwhelming majority of cases. Patients have a right to treatment that includes prevention or adequate relief of pain.

Recognition of the widespread inadequacy of pain management has prompted recent corrective efforts within multiple health care disciplines, including surgery (Kehlet, 1989a; Royal College of Surgeons, 1990), anesthesiology (Phillips and Cousins, 1986; Ready, Oden, Chadwick, Bendetti, Rooke, Caplan, and Wild, 1988); nursing (Jacox, 1977; American Nurses Association, 1991), and pain management groups (National Health and Medical Research Council of Australia, 1988; American Pain Society, 1989; International Association for the Study of Pain, 1991). Although it is not practical or desirable to eliminate all postoperative pain, this clinical practice guideline sets forth procedures to minimize the incidence and severity of acute pain after surgical or medical procedures and trauma. The guideline is designed to help clinicians, patients, and patients' families understand the assessment and treatment of postoperative and other acute pain in both adults and children.

Health care is both a technical and an ethical enterprise. The ethical obligation to manage pain and relieve the patient's suffering is at the core of a health care professional's commitment. While medical treatments often involve risks and burdens, anything harmful to the patient, including postoperative pain, should be

minimized or prevented if possible. The ethical importance of pain management is further increased when additional benefits for the patient are realized—earlier mobilization, shortened hospital stay, and reduced costs. If inadequate pain management results from a clinician's conflict between reducing pain and avoiding potential side effects and/or legal liability, achieving greater technical competence and knowledge of risks and benefits can help to reduce such conflicts.

Prevention is Better than Treatment

Pain is dynamic. Without treatment, sensory input from injured tissue reaches spinal cord neurons and causes subsequent responses to be enhanced. Pain receptors in the periphery also become more sensitive after injury. Recent studies demonstrate long-lasting changes in cells within spinal cord pain pathways after a brief painful stimulus (Bullit, 1989; Fitzgerald, 1990; Hanley, 1988; Hunt, Pini, and Evan, 1987; Przewlocki, Haarmann, Nikolarakis, Herz, and Hollt, 1988). Such physiological studies confirm longstanding clinical impressions that established pain is more difficult to suppress (McQuay, 1989; Wall, 1988; Woolf and Wall, 1986). The health care team should encourage patients to request pain medication before the pain becomes severe and difficult to control. Furthermore, the team should teach patients simple relaxation exercises to help decrease postoperative pain (Ceccio, 1984).

Aggressive pain prevention and control that occurs before, during, and after surgery can yield both short- and long-term benefits. In the very short term, for example, a patient's first request for analgesia after orthopedic surgery occurs later after operations performed with opioid premedication and intraoperative nerve blocks than after general anesthesia alone (McQuay, Carroll, and Moore, 1988). In the short term, patients who undergo cesarean section under epidural anesthesia request less postoperative pain medication in the next 3 days than patients who have general anesthesia (Hanson, Hanson, and Matousek, 1984). Also in the short term, postoperative patients able to self-medicate with small intravenous doses of opioids such as morphine metered out by a programmable infusion pump—patient controlled analgesia or PCA (Ferrante, Ostheimer, and Covino, 1990)—have less pain and are more satisfied with their pain relief. These patients tend to be discharged earlier from the hospital compared with those given the same drug on an "as-needed" basis (Guideline Report, in press; Bollish, Collins, Kirking, and Bartlett, 1985; Eisenach, Grice, and Dewan, 1988; Jackson, 1989; Wasylak, Abbott, English, and Jeans, 1990).

In the long term, after elective limb amputation for vascular insufficiency, patients who receive epidural analgesia before an operation are less likely to have chronic phantom limb pain, in contrast to those conventionally treated (Bach, Noreng, and Tjellden, 1988). Pilot studies such as these that show diverse benefits

of aggressive pain treatment complement controlled clinical trials which indicate that postoperative morbidity and mortality decrease in high-risk populations such as the very young (Anand, Sippell, and Aynsley-Green, 1987) or very old (Egbert, Parks, Short, and Burnnett, 1990) when postoperative care includes aggressive pain relief.

Much of the clinical research cited here is preliminary and needs to be confirmed by properly designed clinical trials. Yet, when considered with laboratory reports and well-documented undertreatment of pain in hospitalized patients, it is likely that routine provision of proactive, aggressive pain treatment will benefit large numbers of postoperative patients. To ensure these benefits, institutions must develop and use formal procedures to assess pain and employ patient-based feedback to gauge the effectiveness of pain control (American Pain Society, 1990, 1991). The flow charts shown in Figures 1 and 2 indicate the points at which caregivers must make decisions about assessing and controlling patient pain.

Organization of the Guideline

To derive maximum benefit, clinicians should read the entire guideline. However, the guideline is organized so that users can go easily to those sections of immediate interest. Following a discussion of why clinicians should take an aggressive approach to prevention and control of postoperative pain, methods of pain assessment are described. Pharmacologic and nonpharmacologic methods of pain control are then presented for general control of postoperative pain, followed by discussion of pain control for specific operative sites and for specific types of patients. The final section discusses institutional responsibility for effective pain management. The appendixes contain a brief description of the methods used for scientific review and a table of scientific evidence for pain intervention, pain assessment tools, drug dosage tables for adults and children, and relaxation exercises.

Process of Pain Assessment and Reassessment

Pain is a complex, subjective response with several quantifiable features, including intensity, time course, quality, impact, and personal meaning. The reporting of pain is a social transaction between caregiver and patient. Therefore, successful assessment and control of postoperative pain depends in part on establishing a positive relationship between health care providers, patients, and (when appropriate) their families. Studies have shown that patients provided with information related to physiological coping (instruction in coughing, deep breathing, turning, and ambulation) reported less pain (Fortin and Kirouac, 1976), were given fewer analgesics postoperatively (Fortin and Kirouac, 1976; Voshall, 1980), and had shorter lengths of stay (Van Aernam and Lindeman, 1971). Egbert, Battit, Welch, and Bartlett (1964) found that providing patients sensory information preoperatively (i.e., detailed descriptions of discomforts to be expected postoperatively) decreased pain, analgesic use, and length of stay. Still other researchers found that patients provided with procedural and sensory information as well as instructions related to physiological coping tended to receive fewer analgesics (Reading, 1982; Schmitt and Wooldridge, 1973) and had shorter lengths of stay than patients who were given less complete information (Schmitt and Wooldridge, 1973).

As noted in the flow charts (Figures 1 and 2), the subject of postoperative pain and its control is a critical part of the initial review of all relevant aspects of the planned procedure. The surgeon should discuss this with the patient and the family. In addition, pain assessment and management issues should be a part of the preoperative workups of the anesthesia and nursing staffs. Patients and their families should be informed that pain reports are valuable and important information, and also that pain may herald surgical complications that demand prompt diagnosis and therapy. To aid in planning and discussing pain control strategies with the patient, a member of the anesthesiology department should obtain a pain history during the preoperative visit. The pain history should include:

- Significant previous and/or ongoing instances of pain and its effect on the patient;
- Previously used methods for pain control that the patient has found either helpful or unhelpful;
- The patient's attitude toward and use of opioid, anxiolytic, or other medications, including any history of substance abuse;

- The patient's typical coping response for stress or pain, including more broadly, the presence or absence of psychiatric disorders such as depression, anxiety, or psychosis;
- Family expectations and beliefs concerning pain, stress, and postoperative course;
- Ways the patient describes or shows pain; and
- The patient's knowledge of, expectations about, and preferences for pain management methods and for receiving information about pain management.

Some patients fear overmedication (e.g., "They will medicate me into oblivion so that I won't be any trouble"). Others know from previous experience that they are prone to side effects of certain drugs (e.g., dysphoria or nausea). Patients who express fears or concerns related to previous analgesic effects may require a cautious approach to medication. Preoperative anxiety may indicate a concurrent medical condition such as substance abuse or withdrawal, hyperthyroidism, anxiety disorder, affective disorder, psychosis, or a medication side effect. Excessive preoperative anxiety should be assessed and a psychiatric or psychologic consultation considered to assist with perioperative management. When the preoperative assessment is complete (as noted in Figure 1), the health care team should develop a pain management plan in collaboration with the patient. When developing the pain management plan, clinicians must consider the relative risks, benefits, and costs of available pain control options. They also should attempt to correct patient misconceptions about the use of pharmacologic or nonpharmacologic strategies.

Once a pain management plan is in place, preoperative preparation of the patient and family is extremely important. Preoperative preparation of patients (and families, when appropriate) assists patients in understanding their responsibilities in pain management. To ensure that postoperative pain measurement is both valid and reliable, the staff should review the selected pain measurement tool—for example, a simple descriptive scale or a visual analog scale—with the patient before surgery. Pain assessment instruments are discussed below and samples are provided in appendix D. The patient should be told how frequently pain will be assessed and asked to select a measurement tool. A member of the health care team should advise the patient that a score above some predetermined criterion of the patient's choosing (e.g., a score of 3-4 on a 10-point scale) will result in a dose increment or other intervention. The patient's negotiation of this criterion is particularly important if the patient fears

Figure 1. Pain Treatment Flow Chart: Pre- and Intraoperative Phases

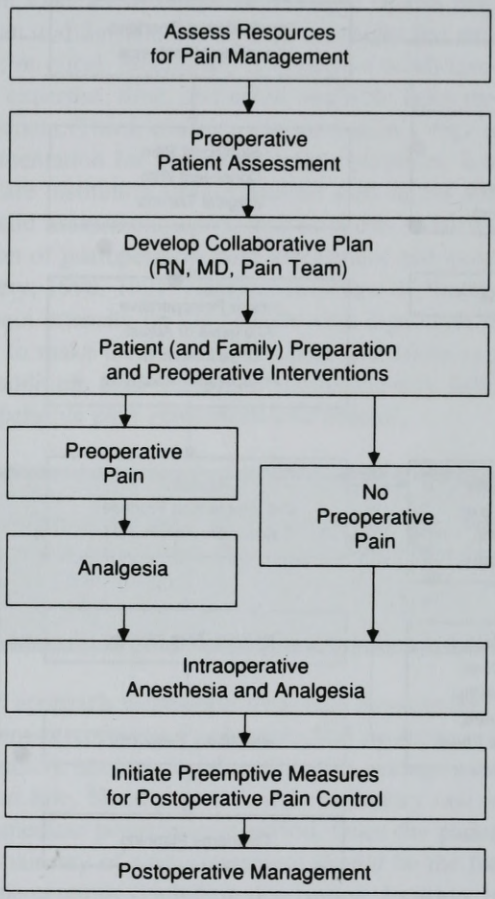
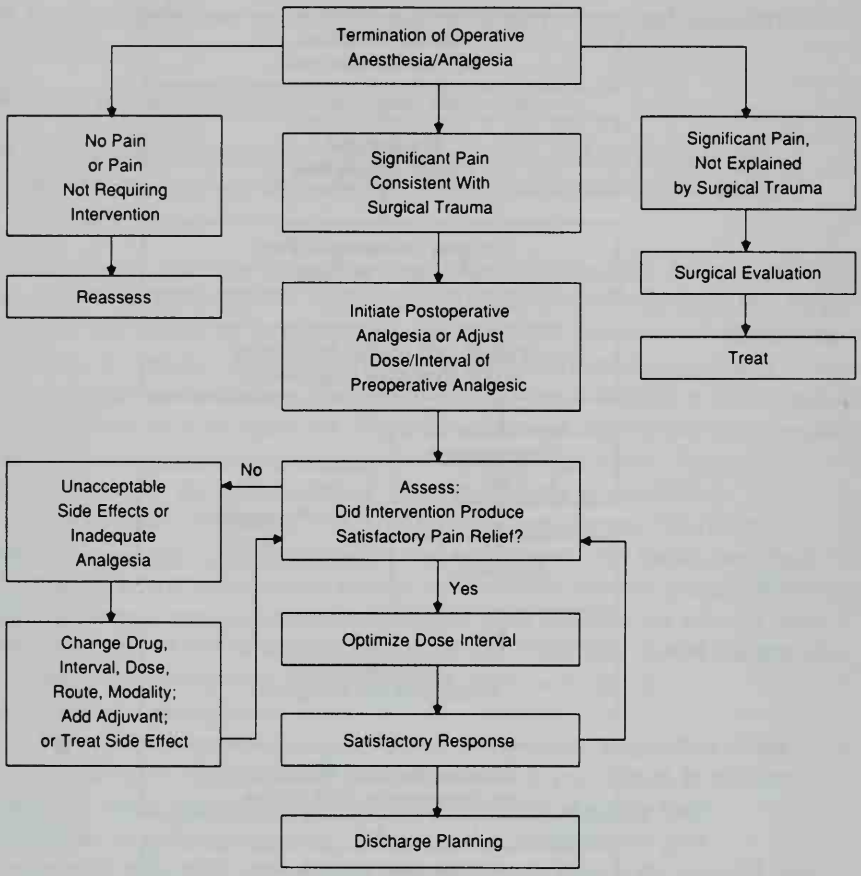

Assess Resources for Pain Management
Preoperative Patient Assessment
Develop Collaborative Plan (RN, MD, Pain Team)
Patient (and Family) Preparation and Preoperative Interventions
Preoperative Pain
Analgesia
No Preoperative Pain
Intraoperative Anesthesia and Analgesia
Initiate Preemptive Measures for Postoperative Pain Control
Postoperative Management

Figure 2. Pain Treatment Flow Chart: Postoperative Phase


Termination of Operative Anesthesia/Analgesia
No Pain or Pain Not Requiring Intervention
Reassess
Significant Pain Consistent With Surgical Trauma
Initiate Postoperative Analgesia or Adjust Dose/Interval of Preoperative Analgesic
Significant Pain, Not Explained by Surgical Trauma
Surgical Evaluation
Treat
Assess: Did Intervention Produce Satisfactory Pain Relief?
No
Unacceptable Side Effects or Inadequate Analgesia
Change Drug, Interval, Dose, Route, Modality; Add Adjuvant; or Treat Side Effect
Yes
Optimize Dose Interval
Satisfactory Response
Discharge Planning

overmedication or intends to cope psychologically with the pain. Patient preferences should be supported.

Assessment of pain after surgery should be frequent and simple. Many different measurement tools are available, and several factors help determine the best choices (Chapman and Syrjala, 1990). First, consider the patient's age; developmental status; physical, emotional, or cognitive condition; and preference. Second, consider the expertise, time, and effort available from the individual performing the assessment. Third, examine the institution's requirements for monitoring and documentation for quality assurance purposes. Based on these factors, each health care institution should educate staff in the proper and consistent use of a valid assessment tool(s) and establish its own quality assurance program for evaluation of postoperative pain assessment and management (American Pain Society, 1990, 1991; National Institutes of Health, 1987). For example, recording pain intensity on the bedside vital sign chart may be considered necessary to make the assessment easily accessible to members of the health care team. In addition, each institution should identify individuals responsible for postoperative pain assessment and control.

The single most reliable indicator of the existence and intensity of acute pain—and any resultant affective discomfort or distress—is the patient's self-report.

A comprehensive approach to postoperative pain assessment requires evaluation of: 1) patient perceptions; 2) physiological responses; 3) behavioral responses; and 4) cognitive attempts by the patient to manage pain. Physiological responses such as heart rate, blood pressure, and respiratory rate provide critical information in the immediate postoperative period. Once the patient has recovered from anesthesia, the mainstay of pain assessment should be the patient's self-report to assess pain perceptions (including description, location, intensity/severity, and aggravating and relieving factors) and cognitive response. Patient self-report is the single most reliable indicator of the existence and intensity of acute pain and any concomitant affective discomfort or distress (National Institutes of Health, 1987). Neither behavior nor vital signs can substitute for a self-report (Beyer, McGrath, and Berde, 1990). Patients may be experiencing excruciating pain even while smiling and using laughter as coping mechanisms (Fritz, 1988).

Samples of commonly used pain assessment tools are in appendix D. Three common self-report measurement tools useful for assessment of pain intensity and affective distress in adults and many children are: 1) a numerical rating scale

(NRS); 2) a visual analog scale (VAS); and 3) an adjective rating scale (ARS). While many researchers prefer visual analog measures (Scott and Huskisson, 1976; Sriwatanakul, Kelvie, Lasagna, Calimlim, Weis, and Mehta, 1983), each of these tools can be a valid and reliable instrument as long as end points and adjective descriptors are carefully selected (Gracely and Wolskee, 1983; Houde, 1982; Sriwatanakul, Kelvie, and Lasagna, 1982).

In practical use, the visual analog scale is always presented graphically, usually with a 10-cm baseline and endpoint adjective descriptors. Patients place a mark on the line at a point that best represents their pain. The visual analog scale is scored by measuring the distance of a patient's mark from the zero. The numerical and adjective rating scales may be presented graphically (see appendix D) or in other formats. For example, numerical rating scales are sometimes presented verbally, and adjective rating scales are presented as a list of pain descriptors. In a graphic format, scoring of the numerical and adjective rating scales may be the same as that described above for the visual analog scale, or they can be scored as numeric integers.

For each of these scales, the clinician should request the patient's self-report, not only with the patient at rest but also during routine activity such as coughing, deep breathing, or moving (e.g., turning in bed). Complaints of pain must be heeded. The patient should be observed for behaviors that often indicate pain, such as splinting the operative site, distorted posture, impaired mobility, insomnia, anxiety, attention seeking, and depression. Patient awareness of pain and the ability to control pain are important components of pain assessment. If pain behavior is observed or if the patient expresses feelings of inadequate control, a member of the health care team should discuss these with the patient and share this information with other members of the team. The management plan should then be revised as needed.

The clinician should document the patient's preferred tool for pain assessment and the goal for postoperative pain control as expressed by a score on a pain scale in the patient's chart as part of the pain history. Simply to record patient responses to the question "how is your pain?" invites misunderstanding or denial and hinders quantification. Pain should be assessed and documented: 1) preoperatively; 2) routinely at regular intervals postoperatively, as determined by the operation and severity of the pain (e.g., every 2 hours while awake for 1 day after surgery); 3) with each new report of pain; and 4) at a suitable interval after each analgesic intervention (e.g., 30 minutes after parenteral drug therapy and 1 hour after oral analgesics). Most important, the team should evaluate immediately each instance of unexpected intense pain, particularly if sudden or associated with oliguria or altered vital signs such as hypotension, tachycardia, or fever, and consider new diagnoses such as wound dehiscence, infection, or deep venous thrombosis.

Each instance of unexpected intense pain, particularly if sudden or associated with oliguria or altered vital signs such as hypotension, tachycardia, or fever, should be immediately evaluated to consider new diagnoses such as wound dehiscence, infection, or deep venous thrombosis.

Occasionally, apparent discrepancies between behaviors and a patient's self-report of pain may occur. For example, patients may describe pain as an 8 out of 10 on a pain scale while smiling and walking freely or as 2 out of 10 while tachycardic, splinting, and sweating. Discrepancies between behavior and a patient's self-report may result from excellent coping skills. The patient who uses distraction and relaxation techniques may engage in diversionary activities while still experiencing severe pain. Patients may deny severe pain for a variety of reasons, including fear of inadequate pain control or a perception that stoicism is expected or rewarded. Similarly, patients managed with as-needed analgesia may perceive that medication will be given only if the pain score is very high. Patients who perceive staff as inattentive to their concerns may use pain as a way to get help for other reasons.

When discussing pain assessment and control with patients, members of the health care team should emphasize the importance of a factual report, thereby avoiding both stoicism and exaggeration. Patients with anxiety or other concerns should rate their mood and emotional distress separately from their pain by using similar scales (see Pain Distress Scales in appendix D). When discrepancies between behaviors and self-reports of pain occur, clinicians should address these differences with the patient. The team and the patient should then renegotiate the pain management plan.

Patients unable to communicate effectively with staff require special consideration for pain assessment, e.g., neonates and children, developmentally delayed persons, psychotic patients, patients with dementia, and non-English speaking patients. Children and cognitively impaired patients require simpler or modified pain measurement scales and assessment approaches (see section on pain in children). The staff should work with both the patient and parent or guardian pre- and postoperatively. Staff should endeavor to find a translator for the non-English speaking patient, at least once, to determine a convenient way to assess pain. Members of the health care team should attend to the preferences and needs of patients whose education or cultural tradition may impede effective communication. Certain cultures have strong beliefs about pain and its

management, and these patients may hesitate to complain about unrelieved pain. Such beliefs and preferences should be determined and respected, if at all possible.

In summary, health care providers should view good pain control as a source of pride and a major responsibility in quality care. Support personnel otherwise untrained in pain assessment should be encouraged to be "pain vigilant" and report to the health care team any patient discomfort, such as during transport or transfer to an x-ray table. At the institutional level, periodic evaluation studies should be conducted to monitor the effectiveness of pain assessment and management procedures. Without institutional support for an organized process by which pain is recognized, documented, assessed, and reassessed on a regular basis, staff efforts to treat pain may become sporadic and ineffectual. A pain care process relying on patients' or families' demands for analgesia "as needed" will produce intervals of inadequate pain control and worsen burdens of anxiety, loss of personal control, sleeplessness, and fatigue after surgery. Patients and their families should understand that pain relief is an important part of their health care, that information about options to control pain is available, and that they are welcome to discuss their preferences with the health care team. Patients should recognize that health professionals will elicit and respond quickly to their pain reports. Before a patient's discharge, those taking care of the patient should describe the interventions used to manage pain and assess their effectiveness. This review, while good practice for each patient, is especially important when initial management was unsuccessful and/or when side effects or other complications occurred.

Options to Prevent and Control Postoperative Pain

Patient education and reduction of any preexisting pain should occur before the operation. Because the goal of the treatment plan is to prevent significant postoperative pain from the outset, treatment alternatives, potential risks, dosage adjustments, and adjunctive therapies should be described to the patient and family. Teaching emphasizes what the patient is likely to experience postoperatively, including the specific method(s) of pain assessment, intervention(s) the staff will employ, and the level of patient participation required. Staff also should inform patients that it is easier to prevent pain than to "chase" or treat it once it has become established, and that communication of unrelieved pain is essential to its relief.

Pain control options include:

- Cognitive-behavioral interventions such as relaxation, distraction, and imagery; these can be taught preoperatively and can reduce pain, anxiety, and the amount of drugs needed for pain control;
- Systemic administration of nonsteroidal anti-inflammatory drugs (NSAIDs) or opioids using the traditional "as needed" schedule or around-the-clock administration (American Pain Society, 1989);
- Patient controlled analgesia (PCA), usually meaning self-medication with intravenous doses of an opioid; this can include other classes of drugs administered orally or by other routes;
- Spinal analgesia, usually by means of an epidural opioid and/or local anesthetic injected intermittently or infused continuously;
- Intermittent or continuous local neural blockade (examples of the former include intercostal nerve blockade with local anesthetic or cryoprobe; the latter includes infusion of local anesthetic through an interpleural catheter);
- Physical agents such as massage or application of heat or cold; and
- Electroanalgesia such as transcutaneous electrical nerve stimulation (TENS).

A postoperative pain management plan might include several of these options. A pamphlet, or "menu" of alternative strategies, can help focus discussion of these options between caregivers and the patient. The postoperative pain management

plan should reflect coexisting and/or ongoing problems such as cancer-related pain or opioid tolerance. The plan should be consistent with the overall surgical and anesthetic plans. For example, an elixir form of analgesic is preferable to a tablet when painful or difficult swallowing is anticipated. Also, if the patient is to have an epidural catheter placed during surgery that could make postoperative pain control simpler or more effective, it should not be removed in the Post-Anesthesia Care Unit (PACU). Staff should note their plans for pre-, intra-, and postoperative pain management in the patient's chart so that other members of the care team can respond to patient questions and coordinate plans for rehabilitation and discharge.

Intraoperative management is often key to the success of postoperative pain control. If pain prevention and control are to be achieved through an epidural catheter, the catheter should be placed and its function verified preoperatively to assure its effective intra- and postoperative use. This is particularly true in patients whose position, body casts, or subsequent anticoagulation make postoperative catheter insertion problematic. The planned pre- and intraoperative use of opioids, and timing of the first postoperative opioid dose by the anesthesiologist, nurse anesthetist, surgeon, or PACU nurse are important in the postoperative care plan. Equally important are decisions during surgery on the concurrent use of local anesthetics (e.g., for intraoperative nerve blocks) and the nature of the surgical incision and placement of drains or tubes (e.g., chest and nasogastric). If TENS is to be used for postoperative pain management, the electrodes may need to be placed intraoperatively. Finally, intraoperative placement of casts and splints to provide support and restrict postoperative movement may enhance other pain management efforts.

Pharmacologic Management

Pharmacologic management of mild to moderate postoperative pain should begin, unless there is a contraindication, with an NSAID. Moderately severe to severe pain normally should be treated initially with an opioid analgesic. After many relatively noninvasive surgical procedures, NSAIDs alone can achieve excellent pain control (Davie, Slawson, and Burt, 1982; Rosen, Absi, and Webster, 1985). NSAIDs decrease levels of inflammatory mediators generated at the site of tissue injury. Even when insufficient alone to control pain, NSAIDs have a significant opioid dose-sparing effect upon postoperative pain and can be useful in reducing opioid side effects (Guideline Report, in press; Hodsman, Burns, Blythe, Kenny, McArdle, and Rotman, 1987; Martens, 1982). The concurrent use of opioids and NSAIDs often provides more effective analgesia than either of the drug classes alone. Although it is likely that NSAIDs also act within the central nervous system, in contrast to opioids, they do not cause sedation or respiratory depression, nor do they interfere with bowel or bladder function. Acetaminophen

does not affect platelet aggregation, nor does it provide peripheral anti-inflammatory activity. Some evidence exists that two salicylates do not affect platelet aggregation profoundly; these are salsalate (Estes and Kaplan, 1980) and choline magnesium trisalicylate (Danesh, Saniabadi, Russell, and Lowe, 1987). All other NSAIDs appear to produce a risk of platelet dysfunction that may impair blood clotting and carry a small risk of gastrointestinal bleeding. At present, one NSAID (ketorolac) is approved by the Food and Drug Administration for parenteral use. The analgesic dosage tables in appendixes B and C include information on NSAIDs, opioids, and other analgesic drugs.

Opioid analgesics are the cornerstone of pharmacological postoperative pain management, especially for more extensive surgical procedures that cause moderate to severe pain. Other agents such as NSAIDs or single injections of local anesthetics may control mild to moderate pain after relatively minor procedures or reduce opioid dose requirements after more extensive operations when this is a goal (Guideline Report, in press; Egan, Herman, Doucette, Normand, and McLeod, 1988; Engberg, 1985a, 1985b; Kaplan, Miller and Gallagher, 1975; Patel, Lanzafame, Williams, Mullen, and Hinshaw, 1983; Sabanathan, Mearns, Bickford Smith, Eng, Berrisford, Bibby, and Majid, 1990; Toledo-Pereyra and DeMeester, 1979). Even in the absence of preemptive efforts targeted at postoperative analgesia, adequate postoperative pain control can usually be achieved with opioid analgesics. When increasing doses of opioids are ineffective in controlling postoperative pain, a prompt search for residual pathology is indicated, and other diagnoses such as neuropathic pain should be considered.

Opioid tolerance or physiological dependence is unusual in short-term postoperative use in opioid naive patients. Likewise, psychologic dependence and addiction are extremely unlikely to develop after patients without prior drug abuse histories use opioids for acute pain (Porter and Jick, 1980). Proper use of opioids involves selecting a particular drug and route of administration and judging: 1) suitable initial dose; 2) frequency of administration; 3) optimal doses of non-opioid analgesics, if these are also to be given; 4) incidence and severity of side effects; and 5) whether the analgesic will be given in an inpatient or ambulatory setting. Titration to achieve the desired therapeutic effect in the immediate postoperative period and to maintain that effect over time should be emphasized.

Opioids produce analgesia by binding to opioid receptors both within and outside the central nervous system. Opioid analgesics are classified as full agonists, partial agonists, or mixed agonist-antagonists, depending on the manner in which they interact with opioid receptors. Full agonists produce a maximal response within the cells to which they bind; partial agonists produce a lesser response, regardless of their concentration; and mixed agonist-antagonists activate one type of opioid receptor while simultaneously blocking another type. Several types and subtypes of such receptors exist. The most important receptor type for

clinical analgesia is named "mu" because of its affinity for morphine. Other commonly used mu opioid agonists include hydromorphone, codeine, oxycodone and hydrocodone, methadone, levorphanol, and fentanyl. All mu opioid agonists have the potential to cause constipation, urinary retention, sedation, and respiratory depression and frequently also produce nausea or confusion. Mixed agonist-antagonists in clinical use include pentazocine [Talwin], butorphanol tartrate [Stadol], and nalbuphine hydrochloride [Nubain]; each of these blocks or is neutral at the mu opioid receptor while simultaneously activating a different type of opioid receptor termed "kappa." Patients receiving mu opioid agonists should not be given a mixed agonist-antagonist because doing so may precipitate a withdrawal syndrome and increase pain. Mixed agonist-antagonists and partial agonists may exhibit a ceiling effect not only with respect to respiratory depression (Nagashima, Karamanian, Malovany, Radnay, Ang, Koerner, and Foldes, 1976; Kallos and Caruso, 1979) but also in regard to their analgesic activity. In the awake patient, there is a clinical ceiling analgesic effect even with morphine because side effects such as respiratory depression limit the dose that may be safely given. However, this does not limit the ability of clinicians to effectively increase the drug dose when the painful stimulus increases and respiratory status is monitored.

Meperidine [Demerol], a mu opioid analgesic, is commonly used for postoperative pain control. Meperidine is commonly underdosed and administered too infrequently even by physicians aware of its pharmacokinetics (Marks and Sachar, 1973). The common postoperative meperidine order of 75 mg parenterally every 4 hours as needed often is inadequate for several reasons. Meperidine produces clinical analgesia for only 2.5-3.5 hours, and a dose of 75 mg every 4 hours is equivalent to only 5-7.5 mg of morphine. Therefore, to obtain postoperative analgesia equal to that from 10 mg of morphine sulfate every 4 hours, a clinician would have to use 100-150 mg of meperidine every 3 hours. Because of its unique toxicity, meperidine is often contraindicated in patients with impaired renal function and those receiving antidepressants of the monamine oxidase inhibitor class (Wood and Cousins, 1989). Normeperidine (6-N-desmethylmeperidine) is a toxic meperidine metabolite excreted through the kidney. In patients with normal renal function, normeperidine has a half-life of 15 to 20 hours; this time is extended greatly in elderly individuals and patients with impaired renal function. Normeperidine is a cerebral irritant that can cause effects ranging from dysphoria and irritable mood to convulsions (Kaiko, Foley, Grabinski, Heidrich, Rogers, Inturissi, and Reidenberg, 1983; Szeto, Inturrisi, Houde, Saal, Cheigh, and Reidenberg, 1977). These effects have been observed even in young, otherwise healthy patients given sufficiently high doses of normeperidine postoperatively. Therefore, meperidine should be reserved for very brief courses in otherwise healthy patients who have demonstrated an unusual

reaction (e.g., local histamine release at the infusion site) or allergic response during treatment with other opioids such as morphine or hydromorphone.

Titration of opioids should be based on the patient's analgesic response and side effects. Remember that patients vary greatly in their analgesic dose requirements and responses to opioid analgesics. Relative potency estimates provide a rational basis for selecting the appropriate starting dose to initiate analgesic therapy, changing the route of administration (e.g., from parenteral to oral), or when switching to another opioid. Dosage conversion factors based on relative potency estimates may differ somewhat between individual patients. When estimating the initial postoperative dose of an opioid analgesic, a clinician should consider whether patients have been receiving opioid analgesics preoperatively. In such patients, supplemental postoperative doses should be adjusted above the preoperative baseline requirement unless the operation itself is likely to remove the painful stimulus.

An "as-needed" order for opioid administration can result in prolonged delays while the nurse unlocks the controlled substances cabinet and prepares the drug for administration and until the drug takes effect. These delays can be eliminated by administering analgesics on a regular time schedule initially. For example, if the patient is likely to have pain requiring opioid analgesics for 48 hours following surgery, morphine could be ordered every 4 hours by the clock (not "as needed") for 36 hours. Once the duration of analgesic action is determined for a patient, the dosage frequency should be adjusted to prevent pain from recurring. Depending on patient preferences, the orders may be written so that the patient can refuse an analgesic if not in pain or forego it if asleep. However, as in dosing with other drugs that require a steady blood level to remain effective, interruption of an around-the-clock dosage schedule during the hours of sleep may cause the patient to be suddenly awakened by intense pain as blood analgesic levels decline.

It may be acceptable late in the postoperative course to give the same drug every 4 hours as requested. Switching from an around-the-clock to an as-needed dosage schedule later in the patient's course is one way to provide pain relief while minimizing the risk of adverse effects as the patient's analgesic dose requirement diminishes. As part of this schedule, a patient's pain should be assessed at regular intervals to determine the efficacy of the drug intervention, the presence of side effects, or the need for dosage adjustment or supplemental doses for breakthrough pain. Effective use of opioid analgesics should facilitate routine postoperative activities—e.g., coughing and deep breathing exercises, ambulation, and physical therapy (Alexander, Parikh, and Spence, 1973; Rawal and Sjostrand, 1986; Wasylak, Abbott, English, and Jeans, 1990). The opioid should be withheld if the patient is sedated when awake or whenever there is respiratory depression (usually fewer than 10 breaths per minute).

Opioids may be administered by a variety of routes; oral dosing is usually the most convenient and least expensive route of administration. It is appropriate as soon as the patient can tolerate oral intake and is the mainstay of pain management in the ambulatory surgical population.

Preoperative intravenous or epidural access may be appropriate for postoperative management of severe pain, even when the oral route is available. Relatively few side effects will occur ordinarily, providing that these modalities are carefully managed by clinicians with appropriate expertise. Using potent analgesics or invasive techniques postoperatively, at a time when a patient's level of consciousness and physical function are returning to normal, requires careful titration and patient assessment.

Drug dosage, frequency, side effects, and risks differ even more noticeably between the intravenous and epidural routes than between the oral and intravenous routes. Clinicians not familiar with epidural opioid doses and pharmacokinetics must review the literature carefully before using that route. In addition, side effects (e.g., confusion, respiratory depression, hypotension, urinary retention, or pruritus) associated with opioids can be greater with intravenous and epidural administration and require ongoing assessment and monitoring. Other potential problems that dictate expert vigilance and followup during epidural analgesia include abscess development or anesthesia of a nerve root at the site of catheter tip. These routes of administration are best limited to specially trained staff who are knowledgeable and skilled in the management of patients receiving intravenous or epidural opioids, typically under the direction of an acute or postoperative pain treatment service.

Patient controlled analgesia is a safe method for postoperative pain management that many patients prefer to intermittent injections. Systemic PCA usually connotes intravenous drug administration, but it also can be subcutaneous or intramuscular. Few studies of the use of PCA drug delivery to the epidural space exist. A typical intravenous PCA prescription applicable to many contexts relies on a series of "loading" doses; for example, 3-5 mg of morphine, repeated every 5 minutes until the initial postoperative pain (if present) diminishes. A low-dose basal infusion (0.5-1 mg/hr) at night allows uninterrupted sleep. On-demand doses typically add 1 mg of morphine every 6 minutes, with a total hourly limit of 10 mg. Once the patient is able to take oral medications, an around-the-clock schedule of an oral opioid such as a codeine-acetaminophen combination is provided, and the basal infusion rate is discontinued. By observing the number of "on-demand" doses self-administered by the patient, the clinician can assess the adequacy of the oral medication and titrate it further, change to a stronger compound such as oxycodone with acetaminophen, or discontinue the PCA pump.

Intravenous administration is the preferred route for postoperative opioid therapy when the patient cannot take oral medications. When intravenous access is problematic, sublingual and rectal routes should be considered as alternatives to traditional intramuscular or subcutaneous injections. All routes other than intravenous require a lag time for absorption of the drug into the circulation. In addition, repeated injections with associated pain and trauma may deter some patients, especially children, from requesting pain medication. Continuous administration of low doses of opioids intravenously or transdermally and intermittent delivery across the buccal mucosa are relatively new but apparently effective methods to administer opioids postoperatively. Further experience is needed to define the clinical roles of these innovative methods in relation to more well-established methods.

Patient controlled analgesia (PCA) is a safe method for postoperative pain management that many patients prefer to intermittent injections.

Opioids and local anesthetic agents interact favorably. Continuous administration into the epidural space of low concentrations of opioids in dilute solutions of local anesthetic provides excellent analgesia, while reducing the potential risks (e.g., respiratory depression or motor block) associated with equianalgesic concentrations of either agent administered singly. In a less technologically demanding approach, systemically administered opioids given pre-, intra-, or postoperatively augment the duration and effectiveness of local anesthetics given spinally or epidurally. Local anesthetics alone may be applied intermittently to specific nerves to interrupt pain pathways. For example, injecting local anesthetics around the intercostal nerves after thoracotomy significantly improves pulmonary function (Guideline Report, in press; Engberg, 1985b; Kaplan, Miller, and Gallagher, 1975; Toledo-Pereyra, and DeMeester, 1979). Catheters for continuous or repeated intermittent dosing of local anesthetic also have been employed postoperatively in the pleural space or adjacent to nerves such as the brachial plexus or cervical sympathetic ganglia. However, a clinical role for interpleural or perineural local anesthetics in the postoperative setting has not yet been defined.

Nonpharmacologic Management

Nonpharmacologic interventions can be classified as either cognitive-behavioral interventions or physical agents. Cognitive and behaviorally based

approaches include several ways to help patients understand more about their pain and take an active part in its assessment and control. The goals of interventions classified as cognitive-behavioral therapies are to change patients' perceptions of pain, alter pain behavior, and provide patients with a greater sense of control over pain. The goals of interventions classified as physical agents or modalities are to provide comfort, correct physical dysfunction, alter physiological responses, and reduce fears associated with pain-related immobility or activity restriction. Nonpharmacologic approaches are intended to supplement, not substitute for, the pharmacologic or invasive techniques described above.

Nonpharmacologic interventions are appropriate for the patient who: 1) finds such interventions appealing; 2) expresses anxiety or fear, as long as the anxiety is not incapacitating or due to a medical or psychiatric condition that has a more specific treatment; 3) may benefit from avoiding or reducing drug therapy (e.g., history of adverse reactions, fear of or physiological reason to avoid oversedation); 4) is likely to experience and need to cope with a prolonged interval of postoperative pain, particularly if punctuated by recurrent episodes of intense treatment- or procedure-related pain; or 5) has incomplete pain relief following appropriate pharmacologic interventions. Cognitive-behavioral approaches include preparatory information, simple relaxation, imagery, hypnosis, and biofeedback. Physical therapeutic agents and modalities include application of superficial heat or cold, massage, exercise, immobility, and electroanalgesia such as TENS therapy.

Giving a patient a detailed description of all medical procedures, expected postoperative discomfort, and instruction aimed at decreasing treatment- and mobility-related pain can decrease self-reported pain, analgesic use, and postoperative length of stay (Guideline Report, in press; Egbert, Battit, Welch, and Bartlett, 1964; Fortin and Kirouac, 1976; Schmitt and Wooldridge, 1973; Voshall, 1980). Patients should receive sufficient procedural and sensory information to satisfy their interest and enable them to assess, evaluate, and communicate postoperative pain. In addition, all preoperative patients should receive instruction emphasizing the importance of coughing, deep breathing, turning, and walking, along with suggestions on how to decrease physical discomforts from such activities. When fear or anxiety occur, it is important to assess psychological coping skills and provide practical suggestions for managing pain and maintaining a positive outlook. Patients who appear anxious or fearful before surgery, and others who express an interest in cognitive-behavioral strategies, should be assisted in selecting an intervention (e.g., simple relaxation or imagery) and taught how to use it. In some patients, particularly those with high levels of anxiety, too much information, or too many demanding decisions can exacerbate fear and pain (Johnson, Fuller, Endress, and Rice, 1978; Johnson, Rice, Fuller, and Endress, 1978). Psychiatric evaluation is appropriate for patients who manifest disabling or

disruptive anxiety symptoms such as emotional instability, restlessness, inability to sleep, and dulled thinking.

Relaxation is the most widely evaluated cognitive-behavioral approach to postoperative pain management. Relaxation strategies, including simple relaxation (Horowitz, Fitzpatrick, and Flaherty, 1984; Lawlis, Selby, Hinnant, and McCoy, 1985; Levin, Malloy, and Hyman, 1987); imagery (Daake and Gueldner, 1989; Horan, Laying, and Pursell, 1976); hypnosis (Kiefer and Hospodarsky, 1980); biofeedback (Madden, Singer, Peck, and Nayman, 1978); and music-assisted relaxation (Locsin, 1981; Mullooly, Levin, and Feldman, 1988), have all shown some degree of effectiveness in reducing pain. Relaxation strategies and imagery techniques need not be complex to be effective. Relatively simple approaches such as the brief jaw relaxation procedure described on page 25 have been successful in decreasing self-reported pain and analgesic use (Flaherty and Fitzpatrick, 1978; Wells, 1982). These strategies take only a few minutes to teach but require periodic reinforcement through encouragement and coaching. Supportive family members or audiotapes often can sustain patient skills. [Sample relaxation and imagery exercises are included in appendix B and printed resource materials or manuals are available elsewhere (McCaffery and Beebe, 1989; Syrjala, 1990).] A relaxation strategy that can be used informally is music distraction. Both patients' personally preferred music (Locsin, 1981) and "easy listening" music (Mullooly, Levin, and Feldman, 1988) have significantly decreased postoperative pain in clinical studies. Patients who need repeated coaching may benefit from the use of a commercially prepared relaxation or music-assisted relaxation audiotape.

Other cognitive-behavioral strategies require greater professional involvement; these include complex imagery, hypnosis, biofeedback, and combined therapies. Such strategies are commonly applied when patients have chronic pain even before surgery.

Examples of Nonpharmacologic Interventions for Postoperative Pain

Cognitive-Behavioral	***Physical Agents***
■ *education/instruction*	■ *applications of heat or cold*
■ *relaxation*	■ *massage, exercise, and immobilization*
■ *imagery*	■ *transcutaneous electrical nerve stimulation*
■ *music distraction*	
■ *biofeedback*	

Although some data suggest that the use of complex imagery may reduce pain (Daake and Gueldner, 1989; Horan, Laying and Pursell, 1976), that biofeedback may lessen pain and operative site muscle tension (Madden, Singer, Peck, and Nayman, 1978; Moon and Gibbs, 1984), and that interventions which combine imagery and relaxation may decrease pain (Mogan, Wells, and Robertson, 1985; Pickett and Clum, 1982; Swinford, 1987), each requires specialized training and, for biofeedback, the use of special equipment. Findings from studies of hypnosis for control of postoperative pain are inconsistent (Daniels, 1976; John and Parrino, 1983; Kiefer and Hospodarsky, 1980; Snow, 1985). Insufficient research to demonstrate effectiveness in reducing postoperative pain and the need for special training or equipment preclude the recommendation of complex imagery, biofeedback, or hypnosis for routine postoperative pain control. This is not to say that patients who have a high level of preoperative anxiety, whose pain is severe and enduring, or who suffer recurrent episodes of procedure-related pain will not benefit from these strategies. However, for such patients a more comprehensive pain management program must include active involvement of professionals skilled in cognitive-behavioral therapy and psychological assessment.

In addition to cognitive-behavioral interventions, several physical therapeutic methods can be used to manage pain (Lee, Itoh, Yang, and Eason, 1990). Commonly used physical agents include applications of heat and cold, massage, exercise, and rest or immobilization. Applications of heat or cold are used to alter pain threshold, reduce muscle spasm, and decrease congestion in an injured area. Applications of cold are used initially to decrease tissue injury response. Later, heat is used to facilitate clearance of tissue toxins and accumulated fluids. Massage and exercise are used to stretch and regain muscle and tendon length. Immobilization is used following many musculoskeletal procedures to provide rest and maintain the alignment necessary for proper healing. With the exception of applications of cold and immobilization, these interventions typically are not used following surgery unless complications occur or an extended postoperative course is expected. When physical modalities are used, it is often for a physiological goal other than pain relief. Of these modalities only cryotherapy (application of cold) has been evaluated in the literature (Cohn, Draeger and Jackson, 1989; Lanham, Powell and Hendrix, 1984; Rooney, Jain, McCormack, Bains, Martini, and Goldiner, 1986). Lanham and colleagues (1984) and Rooney and colleagues (1986) used cryotherapy in association with TENS therapy. There is insufficient evidence to suggest that cryotherapy alone is effective in reducing postoperative pain. Cryotherapy is different from cryoanalgesia (application of a cryoprobe to specific peripheral nerves), which has proven effective for post-thoracotomy pain (Guideline Report, in press).

TENS therapy is one physical modality for which there is some support. TENS therapy has been effective in reducing self-reported pain and analgesic use

Jaw Relaxation Instructions

- *Let your lower jaw drop slightly, as though you were starting a small yawn.*
- *Keep your tongue quiet and resting on the bottom of your mouth.*
- *Let your lips get soft.*
- *Breathe slowly, evenly, and rhythmically: inhale, exhale, and rest.*
- *Allow yourself to stop forming words with your lips and stop thinking in words.*

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following abdominal surgery (Cooperman, Hall, Mikalacki, Hardy, and Sadar, 1977; Hargreaves and Lander, 1989), orthopedic surgery (Jensen, Conn, Hazelrigg, and Hewett, 1985; Smith, Hutchins and Hehenberger, 1983), thoracic surgery (Liu, Liao, and Lien, 1985; Rooney, Jain, McCormack, Bains, Martini, and Goldiner, 1986), mixed surgical procedures (Neary, 1981; Solomon, Viernstein, and Long, 1980; VanderArk and McGrath, 1975), and cesarean section (Davies, 1982; Smith, Guralnick, Gelfand, and Jeans, 1986). TENS therapy also has improved physical mobility following thoracic (Liu, Liao, and Lien, 1985; Warfield, Stein, and Frank, 1985) and orthopedic (Jensen, Conn, Hazelrigg, and Hewett, 1985; Smith, Hutchins, and Hehenberger, 1983) surgery. Both TENS therapy and sham TENS therapy (that is, application of electrodes without transmission of electric current) significantly reduced analgesic use and subjective reports of pain (Guideline Report, in press). No significant differences were found between TENS therapy and sham-TENS (Conn, Marshall, Yadav, Daly, and Jaffer, 1986; Hargreaves and Lander, 1989; Taylor, West, Simon, Skelton, and Rowlingson, 1983). Even though these findings suggest a placebo effect underlies the reduction of perceived pain and analgesic use during TENS therapy, beneficial effects do, in fact, result (Guideline Report, in press). The physical modalities of acupuncture and electroacupuncture also have been clinically evaluated in postoperative patients, with conflicting findings; no clear analgesic effect has been demonstrated (Evron, Schenker, Olshwang, Granat, and Magora, 1981; Facco, Manani, Angel, Vincenti, Tambuscio, Ceccherelli, Troletti, Ambrosio, and Giron, 1981; Hansson and Ekblom, 1986; Wigram, Lewith, Machin, and Church, 1986).

How each patient's postoperative pain management program is designed and implemented will vary according to the type of medical facility and services available to support a pain management program. At the least, clinicians should be introduced to these methods so they recognize the benefits of cognitive-behavioral and physical interventions, know the indications for their use, and are able to provide information and counseling to patients. In addition, patients should have access to written information about available therapies, why and when to use them, and sources for self-management materials or professional consultations.

Catastrophic postoperative events are rarely, if ever, masked by any of the approaches to postoperative pain control previously described. Any sudden or unexplained change in pain intensity requires immediate evaluation by the surgeon. Likewise, a sudden increase in anxiety may signal cardiac or pulmonary decompensation and requires prompt medical or surgical assessment.

Process of Effective Pain Management

Postoperative pain management. As illustrated in the flow chart on page 10 (Figure 2), the process of postoperative pain management is ongoing. Following intraoperative anesthesia and analgesia, postoperative pain assessment and management begin. Based on the preoperative plan, postoperative drug and nondrug interventions are initiated. Patients should be reassessed at frequent intervals (not less than every 2-4 hours for the first 24 hours) to determine the efficacy of the intervention in reducing pain. If the intervention is ineffective, additional causes of pain should be considered, the plan should then be reevaluated, and appropriate modifications should be made. Pharmacologic interventions should be titrated to achieve optimal pain control with minimal adverse effects. Ongoing reassessment ensures satisfactory pain relief with the most appropriate balance of drug and nondrug strategies.

Discharge planning. Inpatients, as well as ambulatory surgical patients, should be given a written pain management plan at discharge. Pertinent discharge instructions related to pain management include: specific drugs to be taken; frequency of drug administration; potential side effects of the medication; potential drug interactions; specific precautions to follow when taking the medication (e.g., physical activity limitations, dietary restrictions); and name of the person to notify about pain problems and other postoperative concerns.

Site-Specific Pain Control

Even for a single operation, there may be great variability in the approach to postoperative pain management based on patient factors such as age, weight, ability to understand and cooperate with plans for care, coexisting medical and psychological problems, and idiosyncratic sensitivity to analgesics; intraoperative course, such as size and location of incisions or drain placement or anesthetic management; and institutional resources available for specialized treatment and monitoring in the particular setting.

Despite these variable factors, the clinician can still outline certain pain management options to present to an adult patient whose management is otherwise uncomplicated. Many aspects of pain control are shared between operations on different parts of the body. For practical reference, pain management options for various surgical procedures are presented according to region of the body rather than by the pathophysiological mechanisms involved. In all cases, however, preoperative psychological preparation and medication should be considered, and ongoing postoperative assessment and reassessment of pain should be routine. In this way, pain can be controlled effectively. Vigilance for changes in postoperative pain will trigger prompt searches for diagnostically significant causes of new pain.

Head and Neck Surgery

Dental surgery. The most common forms of dental surgery are brief and relatively noninvasive procedures often performed on an outpatient basis. A patient's anxiety is frequently disproportionate to the safety of the procedure; such a patient may benefit from behavioral or pharmacologic (anxiolytic) therapy. Mild pain associated with most forms of uncomplicated dental care such as simple tooth extractions, endodontic therapy, or scaling of the periodontal area or of a previously asymptomatic tooth is well managed by oral administration of an NSAID such as aspirin or ibuprofen. Preoperative administration of ibuprofen appears to delay the onset of postoperative pain and lessen its severity (Jackson, Moore, and Hargreaves, 1989). For patients unable to tolerate aspirin or ibuprofen, acetaminophen can provide an acceptable analgesic effect.

Dental procedures such as surgical removal of bony impactions and osseous periodontal surgery are more traumatic and typically produce intense and prolonged postoperative pain. The onset of such pain can be delayed by preoperative treatment with ibuprofen and/or application of a long-acting local anesthetic such as bupivacaine during the procedure.

Rarely, an intravascular or intraneural injection of local anesthetic in this context leads to bruising, bleeding, or systemic symptoms such as fainting, allergic

reaction, or persistent pain due to direct nerve injury. When postoperative pain does emerge, it often requires the addition of an opioid to the nonsteroidal regimen. Codeine is frequently prescribed at a dosage of 30-60 mg every 4-6 hours. Increased analgesia—but also an increased number of opioid side effects such as nausea, constipation, sedation, and respiratory depression—follow dosage increases above this level. Alternative opioids include propoxyphene or oxycodone administered in doses that are equianalgesic to 30-60 mg of codeine.

Some operations on the oral cavity preclude the patient's taking oral medications postoperatively (e.g., wiring the mouth closed after an operation on a mandibular fracture). Alternative therapy should be based on the severity of the surgical procedure and expected pain associated with it, as well as the surroundings in which it will be managed. Formulations of NSAIDs such as rectal suppositories (indomethacin) or intramuscular injection (ketorolac) are now commonly available. Opioids may be administered by a variety of routes (intravenous, intramuscular, subcutaneous injection, transdermal, rectal) and schedules, including a patient controlled schedule. Cost-efficacy analyses of parenteral opioid administration for oral surgery are not sufficient to permit any clear recommendations. Pain that does not respond to these measures should prompt a search for infection, osteitis, peripheral nerve injury, or the emergence of psychological and behavioral changes consistent with the development of chronic pain syndrome.

Radical head and neck surgery. These operative procedures commonly interfere with oral intake for prolonged periods postoperatively and may be combined with a feeding gastrostomy or jejunostomy. Airway patency is always a consideration in these patients, and a tracheostomy frequently is an integral part of the operation. The use of flap coverage or skin grafts further increases the number of potentially painful sites. Prolonged preoperative pain, radiotherapy, and chemotherapy are important preoperative modifiers of pain therapy. Thus, the very nature of the operative procedure may dictate alternate routes for pain therapy in patients who have undergone major head and neck ablative procedures that may interfere with a patient's ability to describe pain and his or her response to analgesic intervention.

Intraoperative positioning of the head and neck are critical. Protective padding and avoidance of extreme flexion, extension, and rotation may help obviate or minimize muscle spasm-induced pain after surgery. Foam cushion supports under the occiput can minimize decubitus, pressure-induced headache, palsies, and causalgia. Intraoperative traction on muscles and nerves should be started carefully and monitored during the operation to prevent reflex myalgias and causalgias. Painful swallowing after head and neck; ear, nose, and throat; and endocrine surgical procedures may require elixir (i.e., liquid) forms of pain medicine, a

modified diet, including liquid or soft foods, and occasional use of topical anesthetics such as viscous lidocaine.

Postoperative pain is often short term and of moderate intensity. Within 1-3 days, parenteral and oral opioids can be discontinued or replaced with non-opioid analgesics (which may have to be delivered via gastrostomy or jejunostomy). The use of most NSAIDs may be contraindicated for such procedures as thyroidectomy and parathyroidectomy where postoperative hemorrhage and risk of airway obstruction are significant. In such cases, acetaminophen or "platelet-sparing" NSAIDs may be ordered.

Neurosurgery. Patients undergoing an operation on the central nervous system frequently show abnormal neurologic signs and symptoms that must be closely followed in the postoperative period. In addition, these patients may receive drugs designed to reduce cerebral edema or prevent seizures. A major dilemma in this clinical setting is the need to carefully monitor critical neurologic signs such as pupillary reflexes and the level of consciousness that may be affected by conventional opioid analgesics used for the relief of postoperative pain.

Ideally, postoperative pain control should not interfere with the ability to assess a patient's neurologic status, particularly the level of consciousness, or with assessment of motor and sensory function following spinal cord surgery. Therefore, the administration of opioids, benzodiazepines, and anxiolytics, in particular, is relatively contraindicated. However, the clinician must balance the need for analgesia with the requirement for appropriate neurologic monitoring.

The uncomplicated postcraniotomy patient typically has mild to moderate pain and is readily managed by a short period of parenteral medications followed by oral analgesics. Laminectomy and other spinal procedures usually are more painful than craniotomies. Ketorolac, a parenteral NSAID, may be considered in this setting because it has no effect on the level of consciousness or pupillary reflexes. As mentioned previously, the use of nonsteroidal analgesics may be contraindicated in some postoperative settings when the risk of coagulopathy or hemorrhage is high, the need to assess fever is important, or when the degree of pain is higher than the analgesic ceiling of the agent.

Epidural opioids and/or local anesthetics can minimize the need for systemic opioids and allow more accurate monitoring of brainstem and cerebral function. However, a single dose of epidural morphine may produce significant blood concentrations (Max, Inturrisi, Kaiko, Grabinski, Li, and Foley, 1985) that in turn cause effects within the central nervous system. A recent study could not demonstrate a difference in neuropsychiatric functioning between patients receiving oral and epidural morphine (Sjøgren and Banning, 1989). Furthermore, motor and sensory dysfunction associated with epidural local anesthetics (which are often coadministered with opioids) may obscure important neurologic signs.

Again, remember to balance the need for adequate analgesia while minimizing the confounding central nervous system effects of analgesics and anesthetics.

Chest and Chest Wall Surgery

Thoracic surgery (noncardiac). Operative sites within the thorax include the heart, esophagus, and lungs and somatically innervated structures such as the ribs, superficial chest wall, and breast. Preexisting disease of these organs (e.g., chronic obstructive pulmonary disease) or prior medical treatment (e.g., chemotherapy) are common. They contribute to postoperative morbidity through a variety of mechanisms, such as decreased pulmonary reserve. Drains and chest tubes can cause intense irritation and pain at entry sites or deeper. For this reason, NSAIDs such as indomethacin in suppository form are useful to reduce inflammation although they are rarely enough for complete pain relief and indeed are not approved by the Food and Drug Administration as simple analgesics.

Good evidence exists that aggressive pain control in the form of epidural analgesia or neural blockade with local anesthetics after thoracic surgery improves pulmonary function; however, at present there is insufficient evidence from randomized controlled trials (RCTs) to conclude that these forms of aggressive pain control after thoracic surgery hasten walking or reduce morbidity and length of hospital stay (Guideline Report, in press; Hasenbos, van Egmond, Gielen, and Crul, 1987; Kaplan, Miller, and Gallagher, 1975; Sabanthan, Mearns, Bickford Smith, Eng, Berrisford, Bibby, and Majid, 1990; Shulman, Sandler, Bradley, Young, and Brebner, 1984).

The greatest beneficial effects result from administration of opioids or a combination of opioid and local anesthetic in the thoracic epidural space. Reliance on a local anesthetic alone to secure postoperative epidural analgesia in the thoracic region carries possible side effects such as hypotension due to sympathetic blockade. Respiratory impairment because of somatic nerve block is another potential problem; therefore, intercostal nerve blocks are generally undesirable unless an opioid is contraindicated. Mixing a local anesthetic with an opioid produces better and more prolonged analgesia, but RCTs indicate that there is a tendency toward more side effects when an opioid is added to a local anesthetic, compared with the local anesthetic alone (Guideline Report, in press; Capogna, Celleno, Tagariello, and Loffreda-Mancinelli, 1988; Pybus, D'Bras, Goulding, Liberman, and Torda, 1983). An example of a coordinated approach to postoperative analgesia is the placement of an epidural catheter prior to induction of anesthesia, which is used to deliver local anesthesia, either alone or mixed with an opioid for intraoperative analgesia, and then left in place postoperatively for infusion of a dilute analgesic. As previously emphasized, monitoring and care of

patients with epidural catheters and assessment of the optimal time for switching to oral analgesia are best accomplished by a specially trained team.

Direct injection of local anesthetics alone to block intercostal nerves has been done for years as a means to provide postoperative analgesia and improved pulmonary function after thoracotomy. Unfortunately, such analgesia lasts only 6 to 12 hours, so that a single injection rarely suffices for the entire postoperative period. A clinician can overcome the brief duration of intercostal anesthesia by administering interpleural local anesthetics. To accomplish this, a catheter is placed between the parietal and visceral pleura, and anesthetic is injected at 4- to 6-hour intervals or infused continuously to produce continuous analgesia across several dermatomes (Scott, Mogensen, Bigler, and Kehlet, 1989). As in all invasive techniques, this method requires skill in drug titration and vigilance for management of side effects such as pneumothorax.

The use of opioids to reduce postoperative pain after thoracotomy is well documented. Because of potential side effects, clinicians have tried to optimize delivery and closely match dose to need. In this context, PCA has resulted in incrementally improved analgesia, increased patient satisfaction, and tendencies towards improved pulmonary function and earlier recovery or discharge (Guideline Report, in press; Eisenach, Grice, and Dewan, 1988; Jackson, 1989; McGrath, Thurston, Wright, Preshaw, and Fermin, 1989; Wasylak, Abbott, English, and Jeans, 1990). One strategy to manage pain after thoracotomy is to deliver epidural analgesia to prevent pain and then switch to patient controlled intravenous analgesia if the epidural catheter ceases to function or is discontinued after several days on the ward.

A typical prescription for intravenous PCA in this setting relies first on a series of "loading" doses: for example, 3-5 mg of morphine, repeated every 5 minutes until the initial postoperative pain diminishes. A low-dose basal infusion at night (e.g., 0.5-1.0 mg/hr) allows uninterrupted sleep for the patient. On-demand doses typically add 0.5-1.5 mg of morphine every 6 minutes. PCA doses of opioid are valuable to supplement analgesia during respiratory therapy or ambulation, even after the patient is taking oral analgesics and especially while chest tubes are in place. The transition from intravenous PCA to oral opioids is accomplished as described above (p. 20). If adequate opioid analgesia yields undesired side effects, or if pain is not severe (e.g., when chest tubes are no longer in place), the patient can switch directly from epidural to oral analgesia using a combination of opioid and NSAID. Many opioid analgesics or mixtures are available in liquid form and are useful for patients unable to swallow tablets or capsules (e.g., after esophageal surgery).

Cardiac surgery. Most cardiac operations involve a median sternotomy and anesthetic induction using high doses of opioids (morphine at 1 mg/kg or another opioid at an equivalent dose). Because somatic nerves are not divided by the

surgical incision, postoperative pain is usually less than after conventional thoracotomy, even when lower doses of opioids are given during surgery. For procedures that use intercostal incisions, such as implantation of automatic defibrillatory devices, methods of pain control need not differ from those of other thoracic operations. Close observation is essential to distinguish postoperative pain originating in the chest wall and pleura from cardiac pain, which may signal myocardial ischemia due to a tachyrhythmia or threatened infarction from inadequate revascularization.

Abdominal and Perineal Surgery

Upper abdominal surgery (includes cholecystectomy, aortic bypass). Although outside the thorax, operations on the upper abdomen such as cholecystectomy compromise pulmonary function. Other associated morbidity (that may lead to mortality) includes immobility, hypercoagulability, venous thrombosis, and increased myocardial oxygen consumption when pain leads to an increase in blood pressure or rapid heart rate. Patients who undergo major vascular surgery frequently have coexisting myocardial disease, wide swings in blood pressure as their major vessels are clamped and unclamped, and significant fluid shifts associated with blood loss and replacement. These patients are particularly at risk for postoperative myocardial infarctions and arrhythmias. For operations on the abdominal aorta, intraoperative epidural anesthesia is widely used and simplifies the transition to postoperative epidural analgesia through the same catheter.

Hormonal indexes of stress are reduced postoperatively in patients given epidural analgesia using a local anesthetic (e.g., 0.25% bupivacaine) such as after cholecystectomy. Yet even when pain is completely eliminated by this technique, these hormonal stress responses do not vanish ("Analgesia and the metabolic," 1985). Normally, a minimum of 3 or 4 days will elapse postoperatively before oral analgesia is feasible following operations on the biliary system, stomach or intestine, or vasculature in the upper abdomen.

In preparing the patient for any upper abdominal operation, choices of pain management to be reviewed with the patient include: intramuscular or subcutaneous injection of an opioid as needed, a "round-the-clock" schedule of injections (or continuous infusion of opioid) to be withheld in the event of side effects such as respiratory depression or nausea, intravenous PCA, or epidural analgesia in the manner described for postthoracotomy pain. Each of these approaches carries its own risks and benefits, which depend on the health care team's knowledge, expertise, and ability to recognize and treat side effects and correct inadequate pain relief. Other techniques have been used for post-cholecystectomy pain, such as interpleural catheters or supplemental,

long-acting local anesthetic blocks of the lower intercostal nerves and celiac plexus. These lie outside the range of most current clinical practice.

Lower abdominal and perineal surgery (includes abdominal hysterectomy, cesarean section, hernia repair, episiotomy, urological and gynecological procedures, and hemorrhoidectomy). The pain management plan for the patient undergoing lower abdominal or perineal surgery is based on the same principles as those for patients undergoing upper abdominal procedures. On the other hand, analgesia to control pain of active labor must be approached with special expertise and caution in light of side effects that may impair fetal well-being (e.g., fetal respiratory depression after maternal opioids or maternal hypotension after epidural local anesthetic). Suppression of pain and surgical stress responses is more complete with epidural local anesthesia after lower abdominal surgery than after upper abdominal operations (Kehlet, 1989b). Presumably this is because pathways such as phrenic or thoracic somatosensory afferents are less easily blocked by epidural anesthesia. Many obstetrical or urological procedures (e.g., cystoscopy) routinely are performed using spinal or epidural anesthesia, and the addition of low doses of opioid to a local spinal anesthetic appears to lengthen the duration of analgesia observed after the local anesthetic effect has subsided (Capogna, Celleno, Tagariello, and Loffreda-Mancinelli, 1988; Chawla, Arora, Saksena, and Gode, 1989; Hanson, Hanson, and Matousek, 1984; Pybus, D'Bras, Goulding, Liberman, and Torda, 1983; Reay, Semple, Macrae, MacKenzie, and Grant, 1989). Pain after procedures on the anus is particularly severe and requires adjunctive measures such as stool softeners, dietary manipulation, and local anesthetic suppositories for control. Again, the precautions already outlined concerning spinal opioid use and the necessity for close monitoring apply. Goals of the postoperative pain management plan should include early ambulation. For obstetric procedures, opioid doses should be adjusted so as to produce minimum maternal and fetal sedation. Alternatively, if an epidural catheter has been placed for infusion of local anesthetic to control labor pain or to provide anesthesia for cesarean section, a dilute solution of local anesthetic may be infused through this catheter to control postoperative pain with little risk of sedating the nursing infant.

Musculoskeletal Surgery

Back surgery. Operations on the spine at any level are frequently done in patients who have experienced chronic pain. Such patients may have the typical complications of chronic pain: depression, anxiety, irritability, and if opioid analgesics were required preoperatively, a relative tolerance to opioid medications. All of these factors may complicate pain assessment and treatment in the postoperative period. In addition, the majority of procedures requiring a spinal

operation are associated with paraspinal muscle spasm. In such cases, it is appropriate to add muscle relaxants to supplement conventional opioid therapy.

Operations on the spinal cord often involve laminectomy and bone grafting and may include opening the dura around the spinal cord. These procedures may limit the role of epidural and spinal delivery of pain medications. As with any neurologic procedure, postoperative patients require careful monitoring of neurologic functions, especially the assessment of sensory, motor, and autonomic functioning.

Surgery on extremities (orthopedic, vascular). Many common operations performed on extremities are elective and include total joint replacements. The high degree of morbidity related to venous thromboembolic complications must be considered. Pain control postoperatively should allow early ambulation and movement in the postoperative period. Supplementing conventional opioids with an epidural infusion of a local anesthetic may benefit these patients by decreasing the incidence of thromboembolism. Operations requiring a cast or other form of external fixation for stabilization demand frequent postoperative evaluation of circulation and neurologic functions. Pain therapy should not interfere with monitoring the patient.

Orthopedic or vascular procedures on an extremity may result in a compartment syndrome; this is usually associated with a period of ischemia or perhaps injury to the muscles of the lower extremity. It is manifested by intracompartmental swelling with loss of function, the earliest manifestation being loss of dorsiflexion of the foot and pain. Once again, this requires continuous observation; pain control measures should not mask this process. If not treated promptly by decompression, a compartment syndrome may result in chronic postischemic neuropathy.

The traumatic amputation is often associated with phantom limb pain. Evidence now exists that infusion of epidural local anesthetic prior to elective amputation for inoperative vascular disease can minimize this symptom (Bach, Noreng, and Tjellden, 1988); the applicability of these pilot data to treatment of other conditions or trauma remains to be defined.

The majority of operative procedures on extremities produce pain of moderate intensity usually controlled by early parenteral opioids supplemented by NSAIDs. Adding epidural analgesia is particularly attractive in terms of establishing early mobility and minimizing thromboembolic complications (Guideline Report, in press; Modig, Borg, Bagge, and Saldeen, 1983; Modig, Borg, Karlstrom, Maripuu, and Sahlstedt, 1983; Pettine, Wedel, Cabanela, and Weeks, 1989).

Soft Tissue Surgery

Surgical procedures involving local soft tissue resections usually obtain pain control with oral opioids. Many of these procedures are done on an ambulatory basis and require careful patient education prior to and immediately after the procedure. Anxiety because of the potential results of a small surgical biopsy (e.g., feared results of a breast biopsy) may demand adjuvant drug or nondrug therapy. Pre- and postoperative education and support by the surgeon and the health care team are supremely important.

Management of Postoperative and Procedural Pain in Infants, Children, and Adolescents

Much of the guideline thus far applies to both adults and children. The following section contains information specific to pain assessment and management in children. This section is not all-inclusive, and these recommendations should be used in conjunction with the entire guideline. This portion of the guideline, although based on a thorough review of the literature on procedure-induced and postoperative pain, is not a substitute for professional training and judgment. For further information, the clinician is referred to the bibliography and, when necessary, to experts for consultation.

Background

Children commonly experience postoperative pain. The incidence of moderate to severe pain in children in any health care setting is influenced by factors such as the child's medical condition, type of procedure performed, and attitudes of health care professionals toward pain management. In three studies on postoperative pain in children, the prevalence of moderate to severe pain varied from about 40 to 60 percent (Hester, Foster, Kristensen, and Bergstrom, 1989; Johnston, Jeans, Abbott, Grey-Donald, and Edgar, 1988; Mather and Mackie, 1983).

Many children do not receive any opioid analgesics after surgical procedures, even though painful postoperative courses are expected (Beyer, DeGood, Ashley, and Russell, 1983; Eland and Anderson, 1977; Foster and Hester, 1990a, 1990b; Hester, Foster, Kristensen, and Bergstrom, 1989; Schechter and Allen, 1986). Compared with adults undergoing similar procedures, less potent analgesic regimens usually are ordered for and given to children (Beyer, DeGood, Ashley, and Russell, 1983; Schechter and Allen, 1986). When used, opioid doses and intervals of administration are often inadequate; when a physician's order includes a selection of one or more analgesics, the tendency is to choose the least potent drugs (Beyer, DeGood, Ashley, and Russell, 1983; Foster and Hester, 1989, 1990a; Mather and Mackie, 1983). In general, although children are less able than adults to articulate their treatment and medication needs, both opioid and non-opioid analgesics are commonly prescribed on an "as-needed" basis (Beyer, DeGood, Ashley, and Russell, 1983; Bush, Holmbeck, and Cockrell, 1989). This type of prescription (a) requires the child or the family to describe the presence of pain and the need for analgesia and (b) focuses on the treatment of emerging pain rather than aggressive treatment to prevent pain.

Infants, even when premature, experience pain in response to aversive stimuli (Anand, 1990; Anand and Aynsley-Green, 1988; Anand, Sippell, and Ansley-Green, 1987; Fitzgerald, Millard, and MacIntosh, 1988, 1989; Fitzgerald, Shaw, and MacIntosh, 1988). However, infants often do not before or after major medical procedures (Franck, 1987). Although the majority of ventilated infants receive postoperative opioid analgesia (but often in less than adequate doses), nonventilated infants often do not (Campbell, Reynolds, and Perkins, 1989; Purcell-Jones, Dormon, and Sumner, 1988; Schnurrer, Marvin, and Heimbach, 1985). A survey of the beliefs and practices of anesthesiologists in the United Kingdom revealed that, although the majority believed neonates experience pain, few provided opioid analgesics for postoperative pain (Purcell-Jones, Dormon, and Sumner, 1987). Discrepancies between beliefs and practices can occur for many reasons, but they have not been adequately explored.

Invasive and painful procedures are particularly distressing for children. Children often describe repeated invasive procedures as more distressing than any other aspect of illness or treatment (Eland and Anderson, 1977; Fowler-Kerry, 1990; Jay, Ozolins, Elliott, and Caldwell, 1983; Weekes and Savedra, 1988). Unlike adults, infants and young children may not understand the reason for procedures and may not participate actively in providing consent. Infants and young children also may not understand the time-limited nature of procedures. Although appropriate preparation and adequate analgesia for painful procedures are crucial for decreasing distress in children, these issues often are not addressed by health care providers, or they are approached haphazardly (Schechter, 1989).

Assessment

Pain is determined by many factors, including the medical condition, developmental level, emotional and cognitive state, personal concerns, meaning of pain, family issues and attitudes, culture, and environment. Caring for the child in pain requires frequent assessment and reassessment of the presence, amount, quality, and location of pain. It also means preventing or reducing anticipated pain and, when prevention is not possible, promptly alleviating pain. Because emotional distress accentuates the experience of pain, exploration of and intervention for possible sources of distress are necessary. For infants and children, the provider should recognize the potential for pain and pursue the possibility that a child is in pain. A knowledge of children, including their developmental level and their behavior, is necessary to adequately assess pain and distress.

Pediatric pain assessment includes a pain history, a search for diagnoses such as infection that could be increasing or causing pain, evaluation of the pain severity and location, and observation of the child and his or her responses to the environment. The inclusion of parents or guardians and other important family

members is essential to pain assessment. Strategies for assessment should be tailored to the developmental level and personality of the child and to the context. Children who are developmentally delayed or retarded, learning disabled, emotionally disturbed, or non-English speaking require special assessment. Culturally determined beliefs about pain and medical care also should be considered. Getting to know the individual child is important for assessment and management of pain: obtaining a pain history and involving the parents in the child's care can optimize this process.

For infants and children, the provider should recognize the potential for pain or suspect that a child is in pain.

The pain history (see appendix D), obtained prior to or at admission, focuses on the language the child uses to describe pain (e.g., hurt, owie, boo-boo), previous pain experiences and coping strategies, how and to whom the child communicates pain, and the child's and the family's preferences to assess and treat pain (Hester and Barcus, 1986). The provider, child, and family can then decide together on their approach to pain assessment and treatment.

Routine assessment and documentation of pain are critical for effective pain control. The frequency of assessment is tailored to the severity of the pain. For example, after a major surgical procedure, assessment reasonably could occur at least every 2 hours on the day of surgery and the first postoperative day and at least every 4 hours on subsequent days. More frequent assessment is necessary if the pain is poorly controlled despite treatment. Pain intensity and its response to analgesics should be recorded on the bedside chart just as vital signs are recorded for easy review by health care providers. Structured documentation on a bedside flow sheet may increase the frequency of assessment and provision of analgesia (Stevens, 1990). Assessment methods should be easy to administer or perform, and documentation forms should be readily accessible to health care providers for use in recording pain. If the child is old enough to participate in assessment, his or her ease in response is important for accurate measurement. Young children may not understand the relationship between pain assessment and pain relief; therefore, they may not respond to questions if they are anxious or in severe pain.

Methods for assessing pain. No one method to assess pain offers an error-free measure of the pediatric pain experience. Therefore, the use of more than one method of assessment may be helpful. Assessment tools should be appropriate for the child's age and cognitive development and for the context. A variety of assessment tools are available for all age groups; selection of

appropriate tools depends on the psychometric adequacy of the tool as determined through estimates of reliability, validity, generalizability, and sensitivity. Several psychometrically sound and developmentally appropriate tools are available to assess pain for documentation on a bedside flow sheet. Representative tools are described in appendix D.

As with adults, a self-report tool provides the most reliable and valid estimates of pain intensity, quality, and location. Self-reports can be used for developmentally normal children over the age of 4 (McGrath, 1990). Self-report tools for children over the age of 4 include the Oucher (Beyer, 1984), the Poker Chip Tool (Hester, 1979; Hester, Foster, and Kristensen, 1990), and a faces scale (McGrath, deVeber, and Hearn, 1985). Children over the age of 7 or 8 who understand the concept of order and number can use a numerical rating scale (McGrath and Unruh, 1987), a horizontal word-graphic rating scale (Savedra, Tesler, Holzemer, and Ward, 1989), or a visual analog scale (Aradine, Beyer, and Tompkins, 1988). In a recent study, 958 well children and adolescents and 175 hospitalized children and adolescents rated the visual analog scale as the least preferred of five horizontal pain scales (Tesler, Savedra, Holzemer, Wilkie, Ward, and Paul, 1991). Reliability and validity for postoperative pain have been established for the Oucher, the Poker Chip Tool, and the horizontal word-graphic rating scale.

Children in pain or otherwise stressed may regress. For example, a child who before surgery uses a numerical scale appropriately may require a simpler scale after surgery. Similarly, children who are developmentally delayed or learning disabled may need assessment tools developed for younger children. If the child is unable or unwilling to respond, ratings can be obtained from the parents or health care providers. However, such ratings often underestimate moderate to severe pain and may overestimate lesser pain (Hester, Foster, Kristensen, and Bergstrom, 1989). To increase accuracy and consistency, ratings from parents and health care providers are obtained using the same tool as the child uses.

Observation of behavior is the primary assessment method for the nonverbal child and may be an adjunct to assessment for the verbal child. Such observations focus on vocalizations, verbalizations, facial expressions, motor responses, and activity. To obtain meaningful observations, the health care professional watches for and documents behaviors associated with distress. Several aspects of behavior should be observed. For example, a child may move easily in bed, guard the surgical site when moving, or be completely immobilized and resist movement.

Various scales based on behavioral observations have been designed for clinical use in infants and preverbal children (Barrier, Attia, Mayer, Amiel-Tison, and Shnider, 1989; Gauvain-Piquard, Rodary, Rezvani, and Lemerle, 1987; McGrath, Johnson, Goodman, Schillinger, Dunn, and Chapman, 1985). Although

reliability and validity have not been well established, these scales offer a guide for observations of postoperative pain.

Use of behavioral observation to guide analgesia requires attention to the context of the child's behavior. For example, children cry not just in response to pain but also in response to fear, loneliness, and over- or understimulation. Thus, additional assessment is necessary when the source of a behavior is not evident, so that all sources of distress can receive appropriate intervention. Sleeping, watching television, or joking may be misinterpreted as indicators of no pain while the child may, in fact, be attempting to control pain. Behavioral responses may be absent or attenuated in circumstances where vocalization or movement increase pain or where intubation, use of paralyzing agents or sedatives, extreme illness, weakness, or depression impede vocalizations and movement. *If care providers are unsure whether a behavior indicates pain, and if there is reason to suspect pain, an analgesic trial can be diagnostic as well as therapeutic.*

Unstructured observations of how a child looks and acts may provide additional information about the presence and amount of pain. Documenting observations over time may reveal specific changes in behavior that serve as important pain indicators. For example, a child may be alert and talkative and then appear sullen and withdrawn. Such a change warrants further investigation since it may indicate the onset of or an increase in pain (Hester and Foster, 1990).

Scales for assessing procedure-related pain have been developed. Assessment of facial expressions and the quality of crying have been used with infants [e.g., Neonatal Facial Coding System (Grunau and Craig, 1987)]. The Procedure Behavior Rating Scale (Katz, Kellerman, and Siegel, 1980) and the Procedure Behavior Checklist (LeBaron and Zeltzer, 1984) have been used with children. These tools are not applicable for routine postoperative use.

Physiologic indicators of pain and distress include heart rate, respiratory rate, blood pressure, and perspiration. However, these indicators are not specific for pain, and they vary among individual patients in pain. Therefore, the interpretation of physiological indicators should be done in the context of the clinical condition and in conjunction with other assessment methods.

Management

Pain is managed by the child, his or her parent(s), nurses, physicians, and other health care providers. Effective interaction is key to effective pain management. Although preferences of the child and the family deserve respect and careful consideration, the primary obligation of the health care provider is to ensure safe and competent care.

Children attempt to prevent or alleviate pain whether or not health care providers do so. When in pain, a child often prefers the use of medication and the

presence of a parent (Adams, 1990; Hester, 1989; Savedra, Gibbons, Tesler, Ward, and Wegner, 1982). However, children may not be in control of these strategies. Specific methods initiated by children that may be helpful include: holding someone's hand, a stuffed toy, or favorite blanket; asking questions; using distraction; sleeping and resting; relaxing or using imagery; changing positions; and engaging in humor. Seemingly simple interventions such as holding someone's hand can have powerful effects. Facilitation of the child's usual strategies for decreasing pain is important.

Although preferences of the child and the family deserve respect and careful consideration, the primary obligation of the health care provider is to ensure safe and competent care.

Management of pain related to procedures in hospitalized children. Diagnostic and therapeutic procedures are often associated with pain. A structured approach to pain management takes into consideration the type of procedure, anticipated range of pain, and individual factors such as age and condition.

Nonpainful procedures (e.g., computed tomographic scanning, magnetic resonance imaging, cast changes, and ultrasonic examination) often require a child to lie still. Preparatory education about the sensations and surroundings may decrease the child's distress and facilitate the procedure (Johnson, Kirchoff, and Endress, 1975). Nondrug approaches such as distraction and imagery may benefit the older child (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990). Sedation is appropriate in these situations, particularly if the child is under 6 years of age. Sedatives include oral chloral hydrate or pentobarbital. Pharmacologic sedation may result in the loss of the child's protective reflexes; therefore, children should be closely monitored even during "conscious sedation."

Painful procedures require a management plan that may include both drug and nondrug approaches. When planning the management of procedure-related pain and anxiety, a series of questions should be asked: 1) Why is the procedure being performed? 2) What is the expected intensity of pain? 3) What is the expected duration of pain? 4) What is the expected intensity of anxiety? 5) What is the expected duration of anxiety? 6) How often will the procedure be repeated? 7) How do the parents think the child will react? and 8) What are the child's and family's perceptions regarding the procedure? The following are general management principles for procedures:

- Treat anticipated procedure-related pain prophylactically.
- Ensure the competency of the person performing the procedure and the timeliness of the procedure (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990). Delays can escalate pain and anxiety. Children report that procedures are easier to tolerate if they know and trust the people doing them.
- Provide adequate and unhurried preparation of the child and family. Parental prediction of the child's response is highly correlated with the actual degree of distress (Fradet, McGrath, Kay, Adams, and Luke, 1990; Schechter, Bernstein, Beck, Hart, and Sherzer, 1991).
- Be attentive to environmental stimuli and the manner in which the child is handled. A room other than the child's room should be used whenever possible. Environmental factors, such as cold or crowded rooms or "beepers" on machines, can escalate distress (Fowler-Kerry, 1990; Hester, 1989).
- Allow parents to be with the child during the procedure. The presence of a parent may be a source of great comfort for the child (Bauchner, Waring, and Vinci, 1991; Shaw and Routh, 1982). The parent's knowledge of the child can be invaluable. Parents should be educated, since they do not automatically know what to do, where to be, and what to say to help their child through the procedure.
- Tailor treatment options, both drug and nondrug, to the child's and the family's needs and preferences, to the procedure, and to the context. A child who undergoes a procedure as part of the treatment for a chronic or life-threatening disease has different needs from the child who has an occasional procedure as part of general well child care or for treatment of an acute but self-limited illness.
- If at all possible, administer pharmacologic agents by a route that is not painful (e.g., oral, transmucosal, or intravenous). If one or two doses of a parenteral agent are necessary and the child does not have intravenous access, a single injection may be preferable to multiple attempts at insertion of an intravenous catheter.
- Dovetail pharmacologic and nonpharmacologic options to complement one another.

- For repeated procedures, maximize treatment for the pain and anxiety of the first procedure to minimize anxiety before future procedures.
- Provide monitoring and resuscitative equipment if drugs are used for sedation. Facilities, equipment, and personnel to manage emergencies (e.g., vomiting and anaphylaxis) should be immediately available.
- Manage preexisting pain optimally before beginning the procedure.
- After the procedure, review with the child and family their experiences and perceptions about the effectiveness of pain management strategies.

Pharmacologic Strategies for Procedural Pain

The needs of the individual child and the type of procedure to be performed shape the pharmacologic approach. As with assessment, the practitioner's expertise and experience with children are key to successful therapy. A pain-relieving agent, such as an opioid (see appendix C for starting doses) or a local anesthetic, is needed to reduce the pain. Anxiolytics and sedatives are used specifically to reduce anxiety before and during the procedure; if used alone, they may blunt the behavioral response without relieving the pain. When anxiety is present, pharmacologic anxiolysis can complement analgesia to decrease overall distress. *The use of systemic analgesics and sedatives must be approached differently in the infant under 6 months of age* (see section on Managing Postoperative Pain in Neonates and Infants).

Agents that have a broad range of applicability include:

- **Local anesthetics**: These agents may be administered by local infiltration or topically. For topical use, a eutectic mixture of local anesthetics (EMLA) (Maunuksela and Korpela, 1986) is promising but not yet available in the United States.
- **Opioids**: These drugs can be given via the intravenous, oral, or transmucosal route. The intravenous route has the advantage of rapid effect and ease of titration. Intravenous opioids can be given in increments (e.g., morphine at 0.03-0.05 mg/kg every 5 minutes) and titrated to analgesic effect. Oral opioids can be used when close and rapid titration to effect is not required.
- **Benzodiazepines:** These agents can be given either orally or intravenously. Like opioids, intravenous benzodiazepines are given in increments and titrated to sedative effect (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990). Unlike diazepam, midazolam does not cause pain and

local sclerosis when given intravenously (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990). Benzodiazepines provide sedation, not analgesia, and hence they often are used with opioids for painful procedures. If the combination of opioid plus benzodiazepine is used, the risk of respiratory depression is increased.

- **Barbiturates**: These drugs provide excellent sedation. They have no analgesic effects and are used with analgesics for painful procedures. For most patients, the sedation persists for many hours after the procedure is completed (Zeltzer, Jay, and Fisher, 1989); rarely, some patients may have paradoxical reactions. As with benzodiazepines, close observation for respiratory depression is essential, particularly when the intravenous route is employed or if an opioid is coadministered.

***Note:** Exercise caution when using the mixture of meperidine (Demerol), promethazine (Phenergan), and chlorpromazine (Thorazine), also known as DPT. DPT—given intramuscularly—has commonly been used for painful procedures. The efficacy of this mixture is poor when compared with alternative approaches, and it has been associated with a high frequency of adverse effects (Nahata, Clotz, and Krogg, 1985). It is not recommended for general use and should be used only in exceptional circumstances.*

Agents such as nitrous oxide and ketamine can be used if trained personnel and appropriate monitoring procedures are available (Zeltzer, Jay, and Fisher, 1989). General anesthesia is appropriate in certain situations (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990).

Monitoring conscious sedation for procedural pain. Skilled supervision is necessary whenever systemic pharmacologic agents are used for conscious sedation (i.e., the patient maintains a response to verbal and physical stimuli). A health care provider not involved in performing the procedure or holding the child should monitor for conscious sedation including frequent assessment of heart rate, respiratory rate and effort, blood pressure, and level of consciousness. Continuous pulse oximetry to measure arterial oxygen saturation is strongly encouraged. Immediate accessibility of resuscitative drugs and equipment and the presence of at least one health professional trained in advanced life support are necessary. After completion of the procedure, monitoring should

continue until the child is fully awake and has resumed the former level of function.

Deep sedation (i.e., the patient is not responsive to verbal or physical stimuli) is equivalent to general anesthesia and should be performed only under controlled circumstances by a professional trained in its use and skilled in pediatric airway management and pediatric basic life support. Reference to specific published guidelines is recommended (American Academy of Pediatrics, 1985; American Academy of Pediatrics, in press). To quote from the latter guideline, "The caveat that loss of consciousness should be unlikely is a particularly important aspect of the definition of conscious sedation, and the drugs and techniques used should carry a margin of safety wide enough to render unintended loss of consciousness highly unlikely. Since the patient who receives conscious sedation may progress into a state of deep sedation and obtundation, the practitioner should be prepared to increase the level of vigilance corresponding to that necessary for deep sedation."

Hospitalized children undergo procedures that include lumbar punctures, chest tube insertions, bone marrow aspirates and biopsies, cardiac catheterization, circumcisions, and burn dressing changes. General principles for the management of procedural pain and distress can be applied to all painful procedures:

- Most hospitalized children undergo minor invasive procedures, such as heelsticks and fingersticks, injections, venipunctures, and insertion of intravenous catheters. Such procedures, even though categorized as "minor," can be a major source of distress for sick or hospitalized children. The hospitalized child benefits from predictability as to time and frequency and "clustering" of procedures, with an identified block of time when no procedures are to be performed, barring emergencies. Intramuscular and subcutaneous routes should be avoided unless necessary for proper administration (e.g., immunizations).

- Nondrug strategies are effective for pain and anxiety associated with minor procedures. Providing emotional support, eliciting concerns, and providing information and age-appropriate choices are crucial. Infants can benefit from sensorimotor interventions (i.e., using a pacifier and using verbal or tactile strategies) (Campos, 1989; Field and Goldson, 1984; Triplett and Arneson, 1979). A variety of strategies have been studied in older children. The child and family can be prepared in several ways, such as provision of preparatory sensation information (Siegel and Peterson, 1980, 1981); empathetic preparation (Fernald and Corry, 1981); and a multimodality approach using stories, art, and play (Fassler, 1985). Other potentially effective cognitive-behavioral strategies include distraction techniques such

as music (Fowler-Kerry and Lander, 1987; Ryan, 1989); coping skills (Siegel and Peterson, 1980, 1981); hypnosis (Andolsek and Novik, 1980; Olness, 1981; Zeltzer and LeBaron, 1982); play therapy (Ellerton, Caty, and Ritchie, 1985); and thought-stopping (Ross, 1984). Physical agents include TENS therapy (Eland, 1989) and counterirritants such as ice (Zeltzer, Altman, Cohen, LeBaron, Maunuksela, and Schechter, 1990). One or more nonpharmacologic intervention in addition to preparation can be chosen by the health care team, family, and child. Choice should be based on the child's preference, personality, and coping style.

For lumbar punctures, local anesthetics are used for all age groups, although efficacy in infants is controversial. Systemic drugs that alter mental status cannot be used in acute medical illnesses, such as meningitis, where observation of the level of consciousness is crucial to treatment. In situations where such monitoring is not necessary, younger children and many older ones benefit from a benzodiazepine. Supplementation with opioids is helpful for some cases, especially when difficulty in performing the procedure is anticipated. Children over 5 years of age who have learned and can effectively use cognitive and behavioral coping skills may prefer not to use sedatives or opioids (Zeltzer, Altman, Cohen LeBaron, Maunuksela, and Schechter, 1990).

Management strategies for bone marrow aspirations and biopsies include use of either general anesthesia or conscious sedation using benzodiazepines and opioids, along with local anesthesia. Adequate time is necessary for the local anesthetic agent to have full effect.

Nonpharmacologic methods with demonstrated efficacy for lumbar punctures and bone marrow aspirates and biopsies include hypnosis (Zeltzer and LeBaron, 1982); thought-stopping (Ross, 1984); and a multidimensional psychological intervention that includes a breathing exercise, reinforcement, imagery, behavioral rehearsal, and filmed modeling (Jay, Elliott, Ozolins, Olson, and Pruitt, 1985). Additionally, the strategies described for minor invasive procedures can be used for lumbar punctures and bone marrow aspirates and biopsies.

The management of pain associated with circumcision is controversial. Circumcision often has a religious context, and the religious beliefs of the family should be respected. Pain associated with circumcision can be managed with a penile block (Maxwell, Yaster, Wetzel, and Niebyl, 1987). However, recent evidence suggests that topical anesthesia may be a safe and effective option (Andersen, 1989; Tree-Trakarn, Pirayavaraporn, and Lertakyamanee, 1987).

Pain Related to Burn Dressing Changes

Burn dressing changes in the child with burns severe enough to require hospitalization are approached in a multidisciplinary fashion, using drug and nondrug strategies. Pain and anxiety coexist in these situations and must be assessed and managed concurrently using opioids and benzodiazepines, respectively. Depending on the child and the level of anxiety, an opioid may be administered alone or used with a benzodiazepine. Since undertreatment of the pain can escalate anxiety, optimal pain control is necessary. Dressing changes occur repeatedly, and tolerance to opioids and benzodiazepines can develop, necessitating higher doses. For efficacy, doses should be increased as needed and titrated according to the response obtained during the previous procecure. The child also may have ongoing pain from the burns in addition to the pain and anxiety of the burn dressing changes. If the ongoing pain is not treated, the child's anxiety during the dressing changes may make it difficult to manage, even with significant doses of opioids and sedatives. Initial regimens for pain management may include a continuous infusion or around-the-clock intermittent doses of an opioid and additional bolus doses of an opioid and a benzodiazepine before the burn dressing changes. For extensive debridement procedures, conscious sedation may not be adequate; general anesthesia may be required.

A variety of nonpharmacologic approaches are effective adjuvants. These include hypnosis (Bernstein, 1963); a multimodal approach involving distraction, relaxation, imagery, and positive reinforcement (Elliott and Olson, 1983); and cartoon viewing with positive reinforcement (Kelley, Jarvie, Middlebrook, McNeer, and Drabman, 1984). Children as young as 18 months do better during burn dressing changes if their participation and control are maximized (Kavanagh, 1983a, 1983b). For example, a child can help to remove his or her own dressings and call for a "time-out" if necessary. Dressing changes are performed in a treatment room or similar place, so that the child can consider his or her room as a safe place. The time and environment for the dressing change should be predictable to the child. The situation causing the burns may be one that produces emotional distress for the child (e.g., burns sustained as a result of the child playing with fire or disobeying rules), and the developing body image of the child may be threatened by the burns. Psychiatric and psychologic intervention should be provided when necessary. Discharge planning initiated soon after admission can help relieve anxiety and increase compliance with the therapeutic regimen, particularly for children with burns on more than 30 percent of the body surface area (Quay and Alexander, 1983).

Management of Pain Associated With Surgical Procedures

Management of surgical pain involves three phases: preoperative, intraoperative, and postoperative.

Preoperative management. Individual or group psychological preparation with or without home preparation (Ferguson, 1979; McGrath, 1979; Visintainer and Wolfer, 1975; Wolfer and Visintainer, 1979) may decrease pain, anxiety, and distress before and after the operation. Parental presence during the induction of anesthesia decreases postoperative pain and reduces adverse psychological sequelae (Hannallah and Rosales, 1983; Johnston, Bevan, Haig, Kirnon, and Tousignant, 1988; Schofield and White, 1989). Preoperative medication should be given painlessly. For example, a child with intravenous access can receive medication by that route; alternative routes for the child without intravenous access include oral, rectal, and transmucosal administration.

Intraoperative management. Adequate analgesia for preterm and fullterm infants significantly reduces surgical stress and postoperative morbidity (Anand, Brown, Causon, Christofides, Bloom, and Aynsley-Green, 1985; Anand and Hickey, 1987). This finding directly challenges the previous practice of providing minimal intraoperative anesthesia for infants based on concerns about the respiratory and hemodynamic side effects of opioids. High dose opioid anesthesia appears to be well tolerated, even in critically ill infants, provided it is used in a carefully monitored setting by skilled anesthesiologists (Collins, Koren, Crean, Klein, Roy, and MacLeod, 1985; Yaster, 1987).

Other intraoperative techniques that may help to reduce, delay, or prevent postoperative pain include epidural blockade with opioids and/or local anesthetics and local anesthetic infiltrated into the wound or applied to block a peripheral nerve. These approaches should be limited to personnel qualified in these anesthetic techniques. Children who receive intraoperative epidural opioids require careful monitoring after the procedure; this method should be used only in settings where such monitoring is available.

Postoperative management. Drug therapies are the most important aspect of pain management. Nondrug techniques to reduce postoperative pain are useful adjuncts; the approaches are similar to those described for procedural pain: relaxation, distraction, the presence of a parent or a special toy or blanket, and cognitive preparation for anticipated events (Hester, 1989). Physical methods, such as positioning with blanket rolls for support and the use of heat or ice, also can be helpful. Pacifiers, swaddling, and a calming environment may be helpful for infants (Campos, 1989; Field and Goldson, 1984).

Drug therapy for postoperative pain depends on the child's age, medical condition, type of surgery, and expected postoperative course. Pain after minor

surgery, such as herniorrhaphy or tonsillectomy, usually can be managed with acetaminophen with or without codeine when the oral route is available. Often children are sent home on the day of surgery after such procedures; thus, parental instruction in pain control is important (Gedaly-Duff and Ziebarth, 1991).

For major surgery, such as abdominal, thoracic, urologic, or orthopedic procedures, parenteral opioids are the mainstay of pain management. These drugs can be administered systemically or spinally, depending on individual needs. NSAIDs are useful in certain situations. Intravenous administration of NSAIDs is currently being studied in children; these and other agents may be used more widely in the future.

Some health care professionals are concerned about the potential for psychological dependence and addiction when using opioids for pain control in children. In adults, the risk of addiction after use of opioids for pain relief is small. Although studies of the risks in children are lacking, no known aspect of childhood development or physiology increases the risk of physiologic or psychologic vulnerability to chemical dependence.

Several issues are pertinent to opioid administration:

- **Route**: In the immediate postoperative period, systemic opioids are delivered by either the intravenous or epidural routes. Intramuscular injections are painful and frightening to children; many children would rather have pain than a "shot" (Eland and Anderson, 1977). Since an intravenous catheter is required for hydration after major surgery, this route is always available. After the child is able to take medication by mouth, an oral opioid can be given with a non-opioid analgesic.

- **Schedule**: Intermittent boluses of opioids can be provided on an around-the-clock basis, using a dose of about 0.1 mg/kg of morphine or its analgesic equivalent. Dose intervals are the same as those recommended for adults. Continuous infusion of morphine (0.02-0.04 mg/kg/hr) for children over 6 months of age has been well studied (Bray, 1983; Hendrickson, Myre, Johnson, Matlak, Black, and Sullivan, 1990; Lynn, Opheim, and Tyler, 1984). Continuous infusion avoids the extreme variations that may occur with intermittent intravenous doses. "Rescue" doses for breakthrough or poorly controlled pain can be offered at regular intervals to patients receiving a continuous infusion. Because of wide variability in the opioid dose needed for adequate analgesia, no matter which route and schedule of administration is employed, pain and side effects (particularly respiratory depression) should be reassessed at frequent intervals and the dose and interval adjusted for the best pain relief.

- **Agent**: As in adults, morphine is the standard. Fentanyl may be preferable when cardiovascular stability is an issue and patients are closely monitored and/or intubated. Meperidine should be used only in exceptional circumstances. (See related discussion on pages 18 and 19.)

- **Patient controlled analgesia**: PCA provides safe and effective analgesia in children as young as 7 years of age (Berde, Lehn, Yee, Sethna, and Russo, 1991). This approach is appropriate for older children and adolescents, since it offers an element of developmentally appropriate control. The addition of a basal infusion may provide better analgesia without increasing the total dose of opioid (Berde, Lehn, Yee, Sethna, and Russo, 1991). Children and young adolescents may benefit from reminders to "push the button for pain" in the immediate postoperative period. Regular assessment and reassessment of pain and side effects, with adjustment of the PCA parameters as indicated, is necessary with PCA. Education of the patient and the family are key to the success of this approach. PCA must be supervised by professionals trained in its use.

- **Side effects**: The pharmacologic approach to managing side effects in children is similar to that in adults. However, young verbal children may have difficulty communicating subjective symptoms, like pruritus, nausea, and dysphoria; the preverbal child may show only generalized discomfort. Assessment of side effects occurs with assessment of pain relief. If an infant or preverbal child becomes increasingly restless or irritable despite an increased opioid dose, treatment of presumed side effects or a change to an alternative opioid can be considered.

- **Monitoring**: Regular assessment of vital signs and level of consciousness is necessary when parenteral opioids are used for managing postoperative pain. Because of wide inter- and intraindividual variations in the response to opioids, an occasional child will have an adverse reaction despite even the most careful titration of doses and intervals. The use of cardiorespiratory monitors is controversial, and professional judgment is required. In any case, machines cannot substitute for skilled and frequent assessment and observation by the health care provider.

Regional Analgesia

Regional analgesia is now widely used for infants and children and may be particularly applicable for young infants as well. Hemodynamic and respiratory effects of major regional analgesia in infants appear minimal (Meignier, Souron, and LeNeel, 1983). The proper use of infusions or intermittent doses of epidural

opioids and/or local anesthetics requires expertise and close monitoring, at least equal to that needed for infants receiving systemic opioids. An acute or postoperative pain service is usually necessary to provide the expertise and vigilance required.

Continuous epidural analgesia is effective for thoracic, abdominal, urologic, and orthopedic procedures (Hendrickson, Myre, Johnson, Matlak, Black, and Sullivan, 1990). Epidural infusions can be administered caudally (especially in children under 6 months of age) or via lumbar or thoracic epidural catheters in older children. Solutions infused into the epidural space are similar to but often more dilute than those applied in adults. Other regional techniques available to children include interpleural continuous infusions, brachial plexus infusions, lumbar sympathetic catheter infusions, and peripheral nerve blockade such as penile blocks.

Managing Postoperative Pain in Neonates and Infants

Young infants, especially premature infants or those who have neurologic abnormalities or pulmonary disease, are susceptible to apnea and respiratory depression when systemic opioids are used (Way, Costley, and Way, 1965; Purcell-Jones, Dormon, and Sumner, 1987). Metabolism is altered so that the elimination half-life is prolonged, and the blood-brain barrier is more permeable (Collins, Koren, Crean, Klein, Roy, and MacLeod, 1985; Koehntop, Rodman, Brundage, Hegland, and Buckley, 1986; Koren, Butt, Chinyanga, Soldin, and Pape, 1985; Lynn and Slattery, 1987). Thus, the adequate management of pain in this age group requires special consideration and expertise.

Clearly, neonates and infants experience pain, and adequate analgesia after surgery is necessary for both physiologic and ethical reasons. Institutions in which major surgery on neonates and infants is performed should provide training for personnel in the effective and safe administration of analgesia for children in this age group, as well as the technologic capability to provide appropriate monitoring. Several aspects of care should be noted.

Age. Some evidence suggests that the clearance of opioids increases rapidly over the first few weeks of life, and approaches adult rates by 1 to 2 months of age (Hertzka, Gauntlett, Fisher, and Spellman, 1989; Koren, Butt, Chinyanga, Soldin, and Pape, 1985; Lynn and Slattery, 1987). Because the available data are based on small numbers of infants, most practitioners reduce the initial dose and use intensive monitoring for infants up to about 6 months of age; this age is arbitrary and based on a cautious interpretation of the literature. It is reasonable to continue intensive monitoring up to about 1 year of age, as extreme sedation and

decreased effort of respiration may be more difficult to assess in this age group than in older children.

Dosing and schedules. Although further investigation is necessary, apnea and respiratory depression appear to be dose related (Koren, Butt, Chinyanga, Soldin, and Pape, 1985). For nonventilated infants under 6 months of age, the initial opioid dose, calculated in milligrams per kilogram, should be about one-fourth to one-third of the dose recommended for older infants and children. For example, morphine could be used at a dose of 0.03 mg/kg instead of the traditional 0.1 mg/kg. Careful assessment is necessary after any dose, so that the optimal dose and interval of administration can be determined from clinical parameters (e.g., when pain breaks through and whether the infant appears comfortable after the dose). Many infants have inadequate pain relief after the initial small dose and require upward titration, sometimes to doses used for older children. Continuous infusions can be used, but a reduced dose is again necessary.

Clearly, neonates and infants experience pain, and adequate analgesia after surgery is necessary for both physiologic and ethical reasons.

Regional analgesia. Regional analgesia for neonates and young infants is as previously described for older infants and children.

Monitoring. Close monitoring of heart and respiratory rates, respiratory effort, blood pressure, and responsiveness to stimuli is mandatory. Frequent or continuous assessment of arterial oxygen saturation using pulse oximetry is a valuable adjunct to close clinical observation. Serum levels of opioids may increase many hours after a one-time intramuscular or subcutaneous dose, presumably due to late release from tissue stores. Thus, monitoring is continued for 24 hours after an opioid dose (Koehntop, Rodman, Brundage, Hegland, and Buckley, 1986).

Non-opioid analgesics. These analgesics (e.g., acetaminophen) can be safely administered to neonates and infants without concern for hepatotoxicity when given for short courses at the recommended doses (Berde, 1989, 1991). Acetaminophen can be given rectally or orally to augment analgesia.

Responsibility for Effective Pain Relief in Children

A formal and structured institutional review of pain management is as necessary for children as for adults. It begins with affirming the rights of all children in any institution to receive the best level of pain relief that can be provided safely. The available methods of pain management should be appropriate for the medical conditions of the children and the surgical procedures that are performed. Recommendations in this guideline (see Responsibility for Effective Pain Relief, page 71) apply to children as well as adults. Patient and family feedback is necessary to ascertain and ensure the adequacy of pain management in children of all ages.

An environment centered on the child is necessary for adequate communication and assessment and to decrease the emotional distress of hospitalization. In addition to a staff experienced in caring for children, a child-centered environment lets parents participate in child care and provides adequate toys and age-appropriate activities.

Critical Questions Regarding the Adequacy of Pain Management Strategies

Knowledge of children—developmentally, behaviorally, and physiologically—is necessary for optimal assessment and treatment. Children are likely to talk less about pain than adults. Thus, the burden of vigilance for pain rests with the health care provider. The following questions focus on decision points of pain management. These questions serve as a guide for the health care provider to optimize pain management. Some children, however, will present with pain that is difficult to manage. In these situations, consultation is recommended.

Children are likely to talk less about pain than adults. Thus, the burden of vigilance for pain rests with the health care provider.

Critical questions to consider before and during pharmacologic management include:

- Have the child and parent(s) been asked about their previous experiences with pain and their preferences for use of analgesics?
- Is the child being adequately assessed at appropriate intervals?

- Are analgesics ordered for prevention and relief of pain?
- Is the analgesic strong enough for the pain expected or the pain being experienced?
- Is the timing of drug administration appropriate for the pain expected or experienced?
- Is the route of administration appropriate (preferably oral or intravenous) for the child?
- Is the child adequately monitored for the occurrence of side effects?
- Are side effects appropriately managed?
- Has the analgesic regimen provided adequate comfort and satisfaction from the child's or parents' perspective?

Parallel questions regarding nonpharmacologic strategies include:

- Have the child and parent(s) been asked about their experience with and preferences for a given strategy?
- Is the strategy appropriate for the child's developmental level, condition, and type of pain?
- Is the timing of the strategy sufficient to optimize its effects?
- Is the strategy adequately effective in preventing or alleviating the child's pain?
- Are the child and parent(s) satisfied with the strategy for prevention or relief of pain?
- Are the treatable sources of emotional distress for the child being addressed?

Other Patients with Special Needs

Elderly Patients

Elderly patients present several pain management problems. First, relatively little attention has been paid to the topic of geriatric pain control in medical or nursing texts (Ferrell, 1991). This is ironic because elderly people often suffer acute and chronic painful diseases, have multiple diseases, and take many medications (From the NIH, 1979). They may have more than one source of pain and an increased risk for drug-drug as well as drug-disease interactions (Kane, Ouslander, and Abrass, 1989). It has been estimated from population studies that the prevalence of pain is two-fold higher in those over age 60 (250 per thousand) compared with those under 60 (125 per thousand) (Crook, Rideout, and Browne, 1984). Among institutionalized elderly, the prevalence may be over 70 percent (Ferrell, Ferrell, and Osterweil, 1990). Indeed, more than 80 percent of elderly people suffer various forms of arthritis, and most will have acute pain at some time (Davis, 1988). Many elective or emergent operations are performed in the elderly to correct orthopedic problems (e.g., fractures, degenerative joint disease). Acute and/or postoperative severe pain related to cancer and its treatment are also more common in the elderly (Foley, 1985). Other acutely painful conditions that affect the elderly disproportionately include herpes zoster, temporal arteritis, polymyalgia rheumatica, and atherosclerotic peripheral vascular disease (From the NIH, 1979).

Second, pain assessment may present unique problems in elderly patients. They often report pain very differently from younger patients due to physiologic as well as psychological and cultural changes associated with aging (Fordyce, 1978). Institutionalized elderly are often stoic about pain (Foley, 1985). Age-associated changes in acute pain perception have long been of interest. Elderly patients often demonstrate altered presentations of common illnesses including "silent" myocardial infarctions and "painless" intra-abdominal emergencies (Bayer, Chada, Farag, and Pathy, 1986; Bender, 1989). Whether these clinical observations are the result of age-associated changes in pain perception remains to be explained. The widespread belief among clinicians that aging results in increased pain thresholds may be a myth. A variety of experiments using heat, pressure, or electrical current have not disclosed a trend regarding age-associated changes in either pain threshold or tolerance. It should be noted that the clinical relevance of these studies remains questionable, since experimentally induced pain may not be analogous to clinically experienced pain (Harkins, Kwentus, and Price, 1984).

Cognitive impairment, delirium (common among acutely ill frail elderly), and dementia (occurring in as many as 50% of institutionalized elderly) represent

serious barriers to pain assessment for which no solution exists in the literature. Whether behavioral observations (e.g., agitation, restlessness, groaning) are sensitive and specific for pain assessment among the demented elderly remains to be shown. Traditional approaches, including the use of visual analog scales, verbal descriptor scales, and numerical scales, have not been psychometrically established in this population. Moreover, a high prevalence of visual, hearing, and motor impairments in the elderly may impede the universal use of such scales by clinicians. Preliminary reports from ongoing work among the nursing home population suggest that many patients with moderate to severe cognitive impairment are able to report acute pain reliably at the moment or when prompted, although pain recall and integration of pain experience over time may be less reliable. If these early observations prove correct, pain assessment among this population may require frequent monitoring. Monitoring may have major implications for quality assurance, quality of care, and quality of life among this large population of elderly people (Ferrell and Ferrell, personal communication: Work in progress on the epidemiology of pain among community nursing homes, July 1991).

The widespread belief among clinicians that aging results in increased pain thresholds may be a myth.

Third, elderly people, especially the frail and old-old (those over 85) are at particular risk for both under- and overtreatment. Unfortunately, few studies of analgesic dosage requirements are performed in the elderly, and most studies have systematically excluded all potential subjects over 65. Age-related observations are extremely variable among elderly people. Indeed, the variance in measurements of most physiologic and pharmacologic parameters increases with age in cross-sectional studies (Kane, Ouslander, and Abrass, 1989). Age-related changes in pharmacokinetics and pharmacodynamics contribute to a variety of adverse drug effects that have been reported in the elderly.

Non-opioid analgesic drugs, including NSAIDs and acetaminophen, are effective and appropriate for a variety of pain complaints in the elderly. However, it is recognized that the risk for gastric and renal toxicity from NSAIDs is increased among elderly patients, and unusual drug reactions including cognitive impairment, constipation, and headaches are also more common in the elderly population (Roth, 1989). If gastric ulceration is a particular concern, coadministration of misoprostol or use of "platelet-sparing" NSAIDs should be considered as a way to lessen the risk of gastrointestinal bleeding.

Opioid analgesic drugs are effective for the management of acute pain in most elderly patients. Cheyne-Stokes breathing patterns are not unusual during sleep in the elderly and need not prompt discontinuation of opioid analgesia unless such analgesia clearly is associated with unacceptable degrees of arterial oxygen desaturation (< 85%). PCA has been shown in at least one study to be safe and effective for postoperative pain relief among selected patients (Egbert, Parks, Short, and Burnett, 1990). If PCA is used, careful titration of dosage is necessary to avoid undesirable effects due to drug accumulation or from a decrease in the arousal effect as painful stimuli subside later in the patient's course. Elderly people are more sensitive to the analgesic effects of opioid drugs as they experience a higher peak and longer duration of pain relief (Bellville, Forrest, Miller, and Brown, 1971; Kaiko, 1980; Kaiko, Wallenstein, Rogers, Grabinski, and Houde, 1982). They are also more sensitive to sedation and respiratory depression probably as a result of altered distribution and excretion of the drugs. This is especially true in opioid-naive patients. Caution is required in the use of longer acting drugs such as methadone for this reason (Ferrell, 1991).

Elderly people, in general, have increased fat-to-lean body mass ratios and reduced glomerular filtration rates (Kane, Ouslander, and Abrass, 1989). Opioids produce cognitive and neuropsychiatric dysfunction through poorly defined mechanisms that in part include the accumulation of biologically active metabolites such as morphine-6-glucuronide or normeperidine (Wood and Cousins, 1989). Opioid dosage titration should take account of not only analgesic effects but also side effects that extend beyond cognitive impairment. These side effects may include urinary retention that looms as a larger threat in elderly males with prostatic hypertrophy, constipation and intestinal obstruction, respiratory depression, or exacerbation of Parkinson's disease. The management of nausea using phenothiazines or antihistamines is fraught with problems, because elderly people are exquisitely sensitive to anticholinergic side effects including delirium, bladder and bowel dysfunction, and movement disorders (Ferrell, 1991).

Local anesthetic infusions may result in cognitive impairment if significant blood levels are reached. Yet prior to that point, orthostatic hypotension may result from sympathetic blockade and clumsiness may ensue from partial motor or sensory anesthesia. Thus, appropriate precautions should be taken, such as help with ambulation or the use of side rails at night.

Finally, attitudes among health care professionals, the lay public, and patients themselves may impede appropriate care. Many members of all three groups consider acute and chronic pain a part of normal aging (Ferrell, Ferrell, and Osterweil, 1990; Ferrell, 1991).

Patients Who Are Known or Suspected Substance Abusers

Management of acute pain in the substance abuser is a difficult but increasingly common clinical problem. Substance abusers experience traumatic injuries (see section on Patients with Shock, Trauma, and Burns) and a variety of health problems more often than the general population. Often during their postoperative care issues arise that prompt the staff to request consultation with specialized "pain teams." For example, the question of possible withdrawal from preexisting opioid use may be raised because sympathetic nervous system stimulation (restlessness, tachycardia, sleeplessness) may be caused by either undertreated pain or opioid abstinence. The related issue of risk of development of substance abuse behaviors in opioid-naive patients given opioid analgesics postoperatively appears to be small based on survey data by Porter and Jick (1980), who found that only four such instances of iatrogenic drug abuse occurred in approximately 12,000 patients screened through the Boston Collaborative Drug Study.

A variety of reports, increasingly frequent in number, have addressed the difficult questions surrounding postoperative opioid use in substance abusers, and several recommendations have recently emerged from reviews of this literature (Portenoy and Payne, in press). First, every effort should be made to define the mechanism of the pain and to treat the primary problem. Infection, tissue ischemia, or a new surgical diagnosis in the postoperative period may require specific measures such as antibiotic therapy, fasciotomy, or re-operation rather than an increase in the opioid dose. Attention to the primary cause of pain symptoms may reduce greatly the requirement for and negotiations about opioid analgesics.

Second, clinicians should distinguish between the temporal characteristics of the abuse behavior. For example, a distant history of substance abuse might predispose to re-emergence of substance abuse behaviors with the stress of surgery and postoperative pain but may not require treatment approaches different from those appropriate for nonaddicted patients. The implications are different for patients with a recent history of active drug abuse who may require higher than usual starting doses of opioids and who may not have acquired an ability to set limits on their drug use.

Third, one should follow relevant pharmacological principles of opioid use. For example, treatment with an opioid agonist-antagonist should not be started in the patient who enters tolerant to opioid agonists such as methadone. Mixed agonist-antagonists may precipitate withdrawal if given in this setting. Loading doses of opioids will be required in normal patients as well as in substance

abusers to reduce the intensity of postoperative pain to acceptable levels. PCA is being used with increasing frequency for many patients, including known substance abusers. This mode of opioid delivery can be utilized safely in substance abusers when appropriate lockout intervals and hourly dosage limits are programmed, and when the device is "tamper-resistant," so that the patient cannot reprogram the pump or remove any drug. If used for an opioid-tolerant patient, PCA doses must be increased to achieve the same analgesic effect as for opioid-naive or nonaddicted patients.

Fourth, just as for other patients, non-opioid therapies should be given concomitantly with or even to replace opioids. Such therapies include NSAIDs, local anesthetic solutions given via catheter into the epidural space or surrounding peripheral nerves, cryoanalgesia, TENS, and nondrug therapies. Appropriate use of non-opioid therapies frequently will reduce the dosage requirement for opioid analgesia.

Fifth, specific drug abuse behavior in the postoperative patient should be recognized and dealt with firmly. Such behavior includes tampering with PCA machines (or other drug delivery devices), hoarding of oral doses of opioid analgesics, or attempting to self-inject the melted contents of capsules or siphoned infusion solutions. At that point, limits of analgesic dosages and expected patient behavior should be made clear to the patient in a frank discussion that also considers the medical, ethical, and legal consequences to the patient and physician if drug abuse behaviors continue. For the most part, security measures already in place (locked closets and inventory checks each nursing shift, antitamper features on PCA machines) will frustrate such attempts. A toxicological screen may be ordered on an inpatient's urine or blood specimens to confirm or exclude a diagnosis of surreptitious drug use (e.g., cocaine administration).

In the outpatient setting, clear instructions (preferably written out and copied into the patient's record) should be offered regarding doses and frequency of medication and the number of days the prescription is expected to last. The addition of a random urine testing procedure to outpatient medication contracts should be considered in all outpatients with a known history of substance abuse who are given opioid analgesics for pain. Opioid medications should be prescribed only by one physician, and attempts to circumvent this restriction or to falsify prescriptions should not be tolerated. The claim of needing additional medication to make up for lost or stolen controlled substances should be accompanied by documentation that the patient has reported this to the police.

Sixth, caregivers should set limits to avoid excessive negotiation about drug selections or choices. For example, it is not appropriate to depart from an institutional policy for morphine use for postoperative analgesia just because of a substance abuser's request for meperidine, as long as the patient has no history of adverse reaction to morphine. Once every effort has been made by clinicians to

adjust a patient's opioid regimen in light of the extent and site of the operation, the patient's prior tolerance to opioids, and clinical response to initial analgesic titration, it is not unreasonable to adhere to this regimen with few, if any, changes. When possible, the treatment plan should include clear criteria (e.g., number of days postoperatively, ability to ambulate) by which opioid doses will be tapered and stopped. Within such a treatment plan, requests for higher dosage by a patient who can walk easily or spends much of the time resting comfortably may appropriately be denied. Consultation should be obtained with appropriate services early in a difficult patient's course. Consultation should help develop a unified multidisciplinary plan that includes, usually, psychiatric, psychological, and substance abuse expertise. Medical input can be obtained beyond the scope of the immediate caretakers to evaluate these and other problematic behaviors. Medical and/or neurologic input can be valuable when assessing neurologic symptoms such as seizures in patients who have recently discontinued alcohol or barbiturate use.

These guidelines will aid the clinician in distinguishing "drug seeking" behaviors from "pain avoidance" behaviors. Often patients who are undertreated for pain and who voice displeasure are labeled as "addicts." This phenomenon has been called "pseudo-addiction" (Weissman and Haddox, 1989). Careful and objective assessment and reassessment of the postoperative patient with an active or previous substance abuse history will minimize the chance of a clinician being "duped" into providing inappropriate opioids but still provide the patient with legitimate pain complaints the opportunity to obtain meaningful and safe pain relief with opioids.

Patients with Concurrent Medical Conditions

Postoperative pain frequently must be treated in patients who have concurrent medical conditions for which they are taking one or more medications. The medical condition *per se* or the medications taken for it may influence the choice of analgesic and its dosage. These medical conditions are frequently chronic, and it may not be possible to discontinue problematic medications because of surgery. The most common medications or classes of medications that produce clinically significant drug interactions with opioid analgesics include alcohol and any central nervous system depressants, phenytoin, and monoamine oxidase inhibitors. Drugs whose primary site of action lies outside the central nervous system (e.g., antibiotics such as rifampin) also may interact with opioid analgesics.

Coexisting conditions themselves influence the type and doses of opioid analgesics and the relative risks of pain treatment in the postoperative period. For example, patients with chronic pain who have been treated recently with opioids

(e.g., patients with cancer and sickle cell disease) will usually require higher-than-the-recommended starting doses to overcome opioid tolerance. Coagulopathy, neutropenia, and sepsis may contraindicate the use of epidural catheters or other regional anesthetic techniques in which the risks of bleeding or "seeding" of infection are increased.

Drug pharmacokinetics may change following surgery because of changes in drug absorption and distribution caused by alterations in cardiac output, venous capacitance, extravascular fluid shifts ("third spacing"), and changes in protein binding. Fever and sepsis in the postoperative period may affect drug disposition, as do shock, trauma, and burns. In addition, patients may not attain clinically effective plasma concentrations of opioids following intramuscular and subcutaneous injections due to pharmacokinetic alterations.

The major factor to consider in selecting analgesics for patients with concurrent medical conditions is whether the disorder produces either hepatic or renal impairment. Most analgesics are metabolized by the liver or kidney, so that any impairment of function in these organs influences the pharmacokinetics of the analgesic. The net result can be drug accumulation. Therefore, caution is essential when using opioids in patients with altered hepatic or renal function. Morphine is metabolized in the liver, and the parent compound, along with the metabolites, is excreted through the kidney. Acute or chronic hepatic failure (e.g., viral hepatitis or cirrhosis) appears to lower plasma clearance of morphine, prolong the terminal elimination half-life, and increase oral bioavailability (Hasselstrom, Eriksson, Persson, Rane, Svensson, and Sawa, 1990). Even mild renal failure, such as that associated with a decline in glomerular filtration rate with aging, can impede excretion of the metabolites of many opioids, resulting in clinically significant narcosis and respiratory depression (Sear, Hand, Moore, and McQuay, 1989). Physiological alterations during surgery (e.g., changes in regional blood flow to the liver or kidneys, hepatic enzyme activity, enterohepatic circulation, or hormonal responses) may also alter drug metabolism and excretion. Meperidine, pentazocine, and propoxyphene have increased bioavailability, prolonged half-lives, and decreased systemic clearance and thus accumulate in hepatic and renal dysfunction. Doses of these drugs must be decreased appropriately. In contrast, the disposition and elimination of methadone are not significantly altered in patients with chronic liver disease.

Renal excretion is a major route of elimination for pharmacologically active opioid metabolites: norpropoxyphene, normeperidine, morphine-6-glucuronide, and dihydrocodeine. Elimination is decreased in patients with renal failure, and doses must be lowered or given less frequently.

For individual patients, it is difficult to predict the degree of impairment of metabolism or excretion of the most commonly used analgesics from either the clinical condition or laboratory indicators of hepatic or renal function because

many factors impinge on clinical response. A lowered initial dose, careful titration of the opioid to desired effect, and ongoing monitoring of clinical response, level of consciousness, and respiratory effort are indicated. Continuous infusions and opioid administration around-the-clock at conventional intervals can result in accumulation of the parent compound or clinically active metabolites. To avoid undertreatment of pain during as-needed dosage schedules, the patient can be assessed at regular intervals, and if stable, a dose of opioid can be offered. PCA does not necessarily protect against accumulation of opioids and respiratory depression (Covington, Gonsalves-Ebrahim, Currie, Shepard, and Pippenger, 1988). In renal failure, especially, a decreased dose and prolonged lockout interval may be required. Non-opioid analgesics are often contraindicated in patients with hepatic or renal dysfunction.

Other diseases that may influence the control of postoperative pain include psychiatric illnesses requiring tricyclic antidepressants and monoamine oxidase inhibitors for treatment; neurologic disorders; pulmonary diseases; and acute and chronic infections.

Patients with respiratory insufficiency and those with chronic obstructive pulmonary disease, cystic fibrosis, and neuromuscular disorders affecting respiratory effort (e.g., muscular dystrophy, myasthenia gravis) are vulnerable to the respiratory depressant effects of opioids. However, when a patient splints his or her respiratory effort because of uncontrolled pain, that also can impair gas exchange. Therefore, careful planning is required to provide effective and safe postoperative analgesia. Unless specific contraindications exist, the use of non-opioid analgesics can be optimized in this group of patients.

However, severe postoperative pain may not be adequately controlled with just these agents. Epidural opioids have a lesser effect on pulmonary function than do systemic opioids (Bromage, Campoersi and Chestnut, 1980). Other regional anesthetic techniques can also be applied in this setting as a way to lower the dosage of systemic opioids required for satisfactory postoperative analgesia. If epidural analgesia cannot be used, small doses of opioids given frequently, continuous infusion, or PCA may provide smoother control of pain with less impact on respiratory effort at the time of peak effect. Whichever method is used to administer systemic opioids, a low initial dose is recommended; later doses can then be titrated to the desired effect. Appropriate monitoring of respiratory rate and effort and adequacy of gas exchange is necessary. Oximetry may be useful in selected cases.

Neurologic disorders can influence postoperative pain management if they: 1) produce weakness of the respiratory muscles (e.g., amyotrophic lateral sclerosis, poliomyelitis); 2) impair alertness and mental function so that the sedative effects of opioids are exaggerated, and pain cannot be assessed easily; and 3) cause seizures requiring use of chronic anticonvulsant medications that may interact with

analgesics. The first two circumstances have been addressed in the discussion above and other sections of this *Guideline*. Phenytoin, a very commonly used anticonvulsant, increases the biotransformation of meperidine, causing faster elimination and necessitating increased doses of this analgesic (Foley and Inturrisi, 1987).

Patients with psychiatric illnesses taking anxiolytics or other psychoactive drugs must be carefully evaluated for drug interactions between the psychotropic and pain medications they take. Because both opioids and psychotropic drugs generally have sedative effects, it is not uncommon for these effects to be additive when the drugs are combined. Further, the tricyclic antidepressants, clomipramine and amitriptyline, may increase morphine levels as measured by an increase in bioavailability and the half-life of morphine (Ventafridda, Ripamonti, DeConno, Bianchi, Pazzuconi, and Panerai, 1987). Of particular importance is avoiding meperidine in patients receiving monoamine oxidase inhibitors. Severe adverse reactions, including death through mechanisms that mimic malignant hyperthermia, have been reported when these drugs have been used together (Armstrong and Bersten, 1986; Foley and Inturrisi, 1987).

Patients treated with drugs for cardiovascular and metabolic disease frequently must continue their drugs throughout the intra- and postoperative period. Fortunately, severe interactions between these drugs and opioids are unlikely.

Alcoholics who must have surgical procedures should be maintained on benzodiazepines or alcohol throughout the intra- and postoperative period to prevent a withdrawal reaction or delirium tremens.

Clinicians must remain aware that patients in the categories discussed in this section may not respond as expected to medications administered for symptom control following surgery. Careful assessment and reassessment of patients' responses to analgesics and dose titration to response are always necessary. The concomitant use of nonpharmacological treatments as adjunctive therapy of postoperative pain is also strongly recommended.

Patients with Shock, Trauma, and Burns

Victims of injury frequently present in a state of cardiovascular or respiratory instability that mandates immediate life-saving procedures (e.g., endotracheal intubation, defibrillation, cut-down, and chest tube insertion) without analgesia. The trauma patient is usually young (58.4%), frequently male (72.8%), and commonly (51.2%) has used alcohol or drugs prior to injury (Soderstrom, Trifillis, Shankar, Clark, and Cowley, 1988).

Beecher (1959) was the first to point out the difficulties in providing analgesia via the intramuscular route following a significant burn or injury. He noted the

variability in absorption from site to site and prolonged absorption times in soldiers with shock. He also provided the basis for modern-day pain control after burns or injuries by suggesting the exclusive use of the intravenous route. Most authorities now recommend incremental small intravenous doses of an opioid analgesic (morphine) carefully titrated to cardiovascular and respiratory stability. Concern for cardiorespiratory instability is particularly important in the first hour after injury. Any analgesic therapy also must allow for continuous monitoring of neurologic status after a head injury and neurovascular status after limb injury.

Once the patient is resuscitated and requires definitive surgical procedures, analgesia should be provided as outlined in this guideline for the various operative sites. The use of NSAIDs in the trauma patient remains controversial. They are undoubtedly of value in the patient with minor trauma, but the risk of excessive bleeding and gastric stress ulcers may prohibit their use following closed head injury, burn injury, or other multisystem injuries. When not contraindicated by sepsis, coagulopathy, or cardiorespiratory instability, the use of regional anesthetic approaches may be beneficial as described earlier for particular operative sites. For example, discomfort and splinting due to flail chest injury may improve with epidural analgesia, and borderline perfusion of an injured limb can increase with a sympathetic blockade by an epidural local anesthetic. On the other hand, surgical evaluation must always take priority over analgesic titration in the face of sudden increases in pain (e.g., extremity swelling) or somnolence (e.g., from an expanding subdural hematoma).

The serious burn injury will require very special pain control after the initial resuscitation. The myth that "third degree burns don't hurt" unfortunately still serves as a basis for widespread institutional denial of pain assessment and treatment for burned patients (Atchison, Osgood, Carr, and Szyfelbein, 1991). Pain control is essentially absent from current reviews of burn management, scientific programs of national burn associations, or funding agendas of the Federal government or major private burn treatment organizations, much as pediatric pain and cancer pain were a decade ago. In reality, after a brief (hours-long) period of endogenous analgesia evoked by the stress of immediate burn injury, pain is often severe and intermittently excruciating for months during burn dressing changes, skin grafts, reconstructive surgery, or other interventions related to needs for prolonged ventilation or intravascular access. Nonviable, insensate tissue is always surrounded by regenerating areas from which pain may arise, considering that viable perfused tissue typically forms the inner margin of an excision. Altered pharmacokinetics and pharmacodynamics in the burn patient, who may be intubated, splinted, and unable to articulate pain, further combine to render pain management an individualized challenge. The almost universal presence of hypotension and vasodilation with or without sepsis generally precludes the use of spinal or epidural routes for pain control until the burn wound is closed. While

some authors have described analgesic regimens for burn dressing changes that call for nonnarcotic analgesics, such as ketamine or nitrous oxide, these approaches are best reserved for unusual or refractory instances because of side effects such as dysphoria (Dripps, Eckenhoff, and Vandam, 1982) or bone marrow depression (Skacel, Hewlett, Lewis, Lamb, Nunn, and Chanarin, 1983), respectively. More typically, high doses of opioids are required to bring pain under control. Even then, there may be pain that is relatively refractory to opioid use, particularly if the burn site is deep or extensive. A morphine infusion alone is inadequate to produce anesthesia, such as for operative procedures or prolonged ventilation, since awareness often persists. Recent clinical studies suggest that damage to underlying nerves may account for the opioid-resistant quality of pain after severe burns (Choinière, Melzack, and Papillon, 1991; Atchison, Osgood, Carr, and Szyfelbein, 1991), and that the continuous infusion of low doses of lidocaine—known to lessen neuropathic pain in other settings—may be a useful analgesic option in patients with burns (Jönsson, Cassuto, and Hanson, 1991). For these reasons, and also because fear and anxiety are an almost universal response to burn injury and trauma of any kind, sedatives such as benzodiazepines are useful to supplement opioid analgesics. In addition, cognitive-behavioral strategies such as relaxation, imagery, and hypnosis have been described by burn survivors as very helpful. The large full-thickness burn with its consequences of pain, separation from family and job, and (frequently) disfigurement, is usually accompanied by depression that may require drugs and, in turn, influence analgesic effects.

Patients Who Have Procedures Outside of the Operating Room

Thousands of patients undergo painful procedures each day outside of operating rooms in emergency departments, clinics, wards, and intensive care units. Analgesia issues outside the operating room also broadly apply to patients who have ambulatory surgical procedures, after which same-day discharge is expected. In any of the above settings, many procedures can be safely performed under local infiltration or regional anesthesia or by adopting behavioral, nondrug strategies, but systemic analgesia is often required to provide optimal pain control.

Only when immediate treatment of cardiorespiratory instability is required, or if a competent patient declines treatment, should analgesia be withheld for a painful procedure. The presence of a condition that could eventually result in cardiovascular, hemodynamic, neurologic, or pulmonary instability (e.g., femur fracture, pneumothorax, skull fracture) is not an absolute contraindication to systemic analgesia, although careful titration and monitoring must be provided.

Though pain control may not be needed for certain procedures (e.g., diagnostic computerized imaging, intravenous pyelogram, or ultrasound examination), providing analgesia is likely to enhance the accuracy of these studies by reducing patient writhing or restlessness because of pain.

No anesthetic or analgesic agent should be used unless the clinician understands the proper technique of administration, dosage, contraindications, side effects, and treatment of overdose. As described earlier, the intravenous route is the preferred delivery mode because of its rapid onset and easy and reliable dosing. Using an intravenous route sidesteps the pain and the unpredictable absorption, onset, and duration of action associated with intramuscular or subcutaneous injections. An intravenous cannula may be placed painlessly following intradermal injection of 1 ml of 1-2% lidocaine through a 27-30 gauge needle. Most often, intravenous titration of an opioid like morphine, with observation for 5-10 minutes between doses, will provide safe and adequate analgesia. Intravenous morphine doses may range from 1 to 10 mg depending on the age, weight, pain intensity, opioid tolerance, and nature of the procedure to be done. Dose titration must be continued throughout the procedure, since pain may break through, for example, during reduction of a joint or vigorous probing of an abscess.

Contraindications to opioid analgesia include altered sensorium, lung disease, pregnancy near term, or an inability to monitor and manage side effects such as respiratory depression in the setting where care is given. Since respiratory depression is strongly correlated with the degree of sedation, stimulation of the patient as well as the administration of small doses of naloxone (e.g., 0.04 mg), may be adequate to reverse mild degrees of hypoventilation. Of course, assisted ventilation by bag and mask, or (ultimately) endotracheal intubation and repetitive naloxone dosing, may be required to reverse more severe degrees of respiratory depression. If such respiratory depression does occur, the patient should be observed until well after the naloxone effect has worn off (usually after 1 hour). Nausea, bradycardia, and hypotension are other side effects to watch for in the clinic, ward, or emergency department.

Other opioids may be used in place of morphine. Meperidine is suitable for brief, titrated dosing but not for prolonged use. Fentanyl may be used in small doses (25 µg increments in the above example) but carries a higher risk than

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morphine or meperidine of inducing chest wall rigidity that must be immediately managed by administering a quick-onset muscle relaxant and supporting ventilation. Apart from chest wall rigidity, any opioid may trigger an acute Parkinson's-like syndrome particularly in the elderly or in patients with Parkinson's disease under medical therapy. Some mixed agonist-antagonists have the advantage that they produce lesser degrees of biliary or ureteral smooth muscle spasm, but they also may precipitate a withdrawal syndrome in patients habituated to opioid agonists such as methadone or heroin (or in other patients taking opioids for chronic pain).

NSAIDs currently have a limited role in the management of pain during brief, painful procedures, but two other nonnarcotic agents have proven useful when administered in monitored settings by trained personnel. Intravenous ketamine has a rapid onset of action and produces a state of conscious sedation in which patients respond to verbal commands and maintain airway reflexes but experience analgesia. Possible side effects include dysphoria, tachycardia, increased salivary and tracheal secretions, and myocardial ischemia in patients with preexisting cardiac disease. Inhalation of a nitrous oxide:oxygen mixture can provide prompt anxiolysis and moderate analgesia. As a precaution, the patient should breathe through a face mask that he or she is holding, so that the mask will drop away if the patient becomes somnolent. Appropriate precautions should be taken to prevent environmental contamination with nitrous oxide (i.e., scavenging system), to avoid the possible inhalation of pure nitrous oxide without oxygen, and to withhold nitrous oxide in cases of altered sensorium, entrapped air such as pneumothorax or pulmonary blebs, bowel obstruction, air embolism, chronic pulmonary disease, or suspected decompression sickness.

Benzodiazepines may be valuable adjuncts to opioids in this setting. Although they lack analgesic properties for treatment of pain due to acute tissue injury, benzodiazepines diminish skeletal muscle spasm (e.g., during orthopedic reduction), reduce anxiety, and in higher doses, provide amnesia. Coadministration of an opioid and a benzodiazepine carries a substantially higher risk of inducing respiratory depression than administration of either drug individually, so particular vigilance is necessary. Typically, in a 70-kg adult, midazolam is used in incremental doses of 1 mg intravenously. Other agents such as phenothiazines (as antiemetics) or antihistamines (because of their weak sedative and analgesic properties) are useful in individual cases.

Regardless of the analgesic or adjuvant given, patients should be monitored closely according to institutional standards. Such standards may include continuous observation of the electrocardiogram, frequent recording of heart rate, blood pressure, and respiratory rate, and pulse oximetry. Considering the risks associated with opioid, benzodiazepine, and other analgesic use, patients should not be left unattended between successive doses of these agents and should be watched for at

least 30 minutes after the completion of outpatient procedures for which intravenous analgesia has been provided. In a transient care setting, patients should not be discharged until they are awake and can converse and ambulate. Once discharged they should be accompanied by an adult for at least two half-lives of the agents used (e.g., at least 6 hours for morphine) and should be advised not to drive an automobile or operate dangerous machinery until it is likely that all medication effects are resolved (usually 24-48 hours). Documentation of monitoring during the procedure, observation prior to discharge, and discharge instructions should be part of the patient's permanent record.

At any site where painful procedures may be performed, equipment should be available to promptly treat any untoward effects of the analgesics selected. Apart from monitoring devices, such equipment includes supplemental oxygen, devices to maintain airway patency (e.g., oral and nasal airways, face masks, endotracheal tubes, laryngoscopes, and a bag-valve device), suction, drugs for resuscitation (e.g., atropine, naloxone), and a defibrillator. Most important, there must be present on site a physician or other provider skilled in resuscitation, particularly airway management.

Responsibility for Effective Pain Relief

Optimal application of pain control methods depends on cooperation between different members of the health care team throughout the patient's course of treatment. To ensure that this process occurs effectively, formal means must be developed and used within each institution to assess pain and to obtain patient feedback to gauge the adequacy of its control (American Pain Society, 1990, 1991; National Institutes of Health, 1987).

The institutional process of acute pain management begins with an affirmation that patients should have access to the best level of pain relief that may safely be provided. Each institution should develop the resources necessary to provide the best and most modern pain relief appropriate to its patients.

In any setting, the quality of pain control will be influenced by the availability of a pain management program and the training, expertise, and experience of its members. There is wide variation among institutions in size, complexity, volume of surgical procedures, and differing patient populations; therefore, different pain management programs are suitable. In all cases, responsibility for this care should be assigned to those most knowledgeable, experienced, interested, and available to deal with patients' needs in a timely fashion.

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Risks associated with sophisticated options for effective pain relief, such as epidural analgesia or PCA, are minimized by encouraging their application in an organized, methodical fashion with frequent followup and titration. It is logical to assign responsibility for effective pain relief under such circumstances to experts working in dedicated groups. The sense of security present in many hospitals where such dedicated groups are active should not seduce other providers into offering sophisticated pain relief options beyond the institutional resources to manage them vigilantly. Patient controlled or epidural analgesia, or even conventional analgesia given by injection, are all potentially lethal. Death can occur if dosages are not titrated, drug interactions not watched for, and patients not monitored for side effects like respiratory depression. In this sense, analgesics should be prescribed with no less care and expertise than other medications such as digitalis or insulin. In settings where pain management teams are not feasible

(e.g., surgicenters, primary care clinics, or nursing homes), less sophisticated options may be appropriate, yet responsibility for effective pain control should still be assigned to designated, accountable individuals. Only if institutions recognize the importance of effective pain control and assign responsibility to interested individuals or groups can the quality of care in this area be at its best.

The key items to be considered when developing an institutional quality assurance program to monitor the provision of pain relief are:

- Patient comfort and satisfaction with pain management.
- The range and appropriateness of options available within a particular institution.
- How those options can best be applied.
- Minimizing side effects and complications related to pain control.

Implementation of this guideline requires more than quality assurance procedures: interdisciplinary, interprovider collaboration should occur. Three elements are essential for interdisciplinary collaboration: a common purpose, diverse professional skills and contributions, and effective coordinating and communicating processes. For nurses, physicians, and others treating acute pain, the common purpose is relief of patients' pain. The purpose should be *explicit*, and a *commitment* to this goal should be elicited from *every* provider who can influence the patient's pain. Each health professional's diverse and complementary skills and contributions should be recognized and used toward meeting the common goal of pain relief. Knowledgeable and talented providers with a common purpose may not achieve effective pain control without effective communication and coordination. The following elements will help ensure successful collaboration:

- Clarity among professionals about what they can and will contribute (such as, who will coordinate pain management—primary nurse and attending physician or specialized pain control team?; can consultants write prescriptions or orders?).
- Decisionmaking that reflects input from the patient and family (when appropriate), such as providing when feasible a menu of pain control choices that includes pharmacologic and nonpharmacologic means.
- Contingency planning, such as orders to avert or treat possible drug side effects like constipation, nausea, or urinary retention; a range of analgesic doses to deal with varying pain intensity; postdischarge followup of acute

pain problems such as phantom pain; and clear coverage for off-shifts or weekends.

- Regular meetings (e.g., daily rounds) of *all* providers (as many and as interdisciplinary as possible) at *mutually* convenient times to maximize communication and information sharing.

In addition to the above clinical communications, interpersonal issues of power, leadership, and conflict can hamper efforts to relieve pain. An ability to analyze these situations, as well as interpersonal competence in leadership and conflict resolution, are vital for *building teams and keeping them focused on their shared purpose of relieving pain.*

Summary

Summary recommendations 1-5 and 7, below, should be implemented in every hospital where operations are performed on inpatients. The Acute Pain Management Guideline Panel recommends that any hospital in which abdominal or thoracic operations are routinely performed offer patients postoperative regional anesthetic, epidural or intrathecal opioids, PCA infusions, and other interventions requiring a similar level of expertise, under the supervision of an acute pain service as described in summary recommendation 6, below. For pain management to be effective, each hospital must designate who or which department will be responsible for all of the required activities.

There are a number of alternative approaches to preventing or relieving postoperative pain, many of which can give good results if attentively applied. The following elements, however, apply to most cases and might serve as a focus for assessing the results of these guidelines:

1. *Promise patients attentive analgesic care.* Patients should be informed before surgery, verbally and in printed format, that effective pain relief is an important part of their treatment, that talking about unrelieved pain is essential, and that health professionals will respond quickly to their reports of pain. It should be made clear to patients and families, however, that the total absence of any postoperative discomfort is normally not a realistic or even a desirable goal.

2. *Chart and display assessment of pain and relief.* A simple assessment of pain intensity and pain relief should be recorded on the bedside vital sign chart or a similar record that encourages easy, regular review by members of the health care team and is incorporated in the patient's permanent record. The intensity of pain should be assessed and documented at regular intervals (depending on the severity of pain) and with each new report of pain. The degree of pain relief should be determined after each pain management intervention, once a sufficient time has elapsed for the treatment to reach peak effect. A simple, valid measure of intensity and relief should be selected by each clinical unit. For children, age-appropriate measures should be used.

3. *Define pain and relief levels to trigger a review.* Each institution should identify pain intensity and pain relief levels that will elicit a review of the current pain therapy, documentation of the proposed modifications in treatment, and subsequent review of its efficacy. This process of treatment review and followup should include participation by physicians and nurses involved in the patient's care.

4. *Survey patient satisfaction.* At regular intervals defined by the clinical unit and quality assurance committee, each clinical unit should assess a randomly selected sample of patients who have had surgery within 72 hours. Patients should

be asked their current pain intensity, the worst pain intensity in the past 24 hours, the degree of relief obtained from pain management interventions, satisfaction with relief, and their satisfaction with the staff's responsiveness.

5. *Analgesic drug treatment should comply with several basic principles*:
   a. *Non-opioid "peripherally acting" analgesics.* Unless contraindicated, every patient should receive an around-the-clock postoperative regimen of an NSAID. For patients unable to take medications by mouth, it may be necessary to use the parenteral or rectal route.
   b. *Opioid analgesics.* Analgesic orders should allow for the great variation in individual opioid requirements, including a regularly scheduled dose and "rescue" doses for instances in which the usual regimen is insufficient.

6. *Specialized analgesic technologies*, including systemic or intraspinal, continuous or intermittent opioid administration or patient controlled dosing, local anesthetic infusion, and inhalational analgesia (e.g., nitrous oxide) should be governed by policies and standard procedures that define the acceptable level of patient monitoring and appropriate roles and limits of practice for all groups of health care providers involved. The policy should include definitions of physician and nurse accountability, physician and nurse responsibility to the patient, and the role of pharmacy.

7. *Nonpharmacological interventions*: Cognitive and behaviorally based interventions include a number of methods to help patients understand more about their pain and to take an active part in its assessment and control. These interventions are intended to supplement, not replace, pharmacological interventions. Staff should give patients information about these interventions and support patients in using them.

8. *Monitor the efficacy of pain treatment*: Periodically review pain treatment procedures as defined in summary recommendations 1-4 above, using the institution's quality assurance procedures.

References

Adams, J. (1990). A methodological study of pain assessment in Anglo and Hispanic children with cancer. In Tyler, D. & Krane, E. (Eds.), *Advances in pain research and therapy: Pediatric pain* (vol. 15, pp. 43-52). New York: Raven Press.

Alexander, J.I., Parikh, R.K., & Spence, A.A. (1973). Postoperative analgesia and lung function: A comparison of narcotic analgesic regimens. *British Journal of Anaesthesia*, 45, 346-352.

American Academy of Pediatrics. (1985). Guidelines for the elective use of conscious sedation, deep sedation, and general anesthesia in pediatric patients. *Pediatrics*, 76, 317-321.

American Academy of Pediatrics. (In press). Guidelines for monitoring and management of pediatric patients during and following sedation for diagnostic and therapeutic procedures. *Pediatrics*.

American Nurses Association. (1991). *Position statement on the registered nurses' (RN) role in the management of patients receiving I.V. conscious sedation for short-term therapeutic, diagnostic, or surgical procedures*. Kansas City: American Nurses Association.

American Pain Society. (1989). *Principles of analgesic use in the treatment of acute pain and chronic cancer pain: A concise guide to medical practice* (2nd ed.). Skokie, IL: American Pain Society.

American Pain Society, Committee on Quality Assurance Standards. (1990). Standards for monitoring quality of analgesic treatment of acute pain and cancer pain. *Oncology Nursing Forum*, 17, 952-954.

American Pain Society quality assurance standards for relief of acute pain and cancer pain. (1991). In Bond, M.R., Charlton, J.E., & Woolf C.J. (Eds.), *Proceedings of the 6th World Congress on Pain*. Amsterdam, NY: Elsevier Science Publications.

Analgesia and the metabolic response to surgery (Editorial). (1985). *Lancet*, 1, 1018-1019.

Anand, K. (1990). The biology of pain perception in newborn infants. In Tyler, D. & Krane, E. (Eds.), *Advances in pain research and therapy: Pediatric pain* (vol. 15, pp. 113-122). New York: Raven Press.

Anand, K.J. & Aynsley-Green, A. (1988). Measuring the severity of surgical stress in newborn infants. *Journal of Pediatric Surgery*, 23, 297-305.

Anand, K.J., Brown, M.J., Causon, R.C., Christofides, N.D., Bloom, S.R., & Aynsley-Green, A. (1985). Can the human neonate mount an endocrine and metabolic response to surgery? *Journal of Pediatric Surgery*, 20, 41-48.

Anand, K.J. & Hickey, P. (1987). Pain and its effects in the human neonate and fetus. *New England Journal of Medicine*, 317, 1321-1329.

Anand, K.J., Sippell, W.G., & Aynsley-Green, A. (1987). Randomized trial of fentanyl anaesthesia in preterm babies undergoing surgery: Effects on the stress response. [Published erratum appears in *Lancet* 1987 Jan 24, 1, 234.] *Lancet*, 1, 62-66.

Andersen, K.H. (1989). A new method of analgesia for relief of circumcision pain. *Anaesthesia*, 44, 118-120.

Andolsek, K. & Novik, B. (1980). Use of hypnosis with children. *Journal of Family Practice*, 10, 503-507.

Anscombe, A.R. & Buxton, R.J. (1958). Effect of abdominal operations on total lung capacity and its subdivisions. *British Medical Journal*, 2, 84-87.

Aradine, C.R., Beyer, J.E., & Tompkins, J.M. (1988). Children's pain perception before and after analgesia: A study of instrument construct validity and related issues. *Journal of Pediatric Nursing*, 3, 11-23.

Armstrong, P.J. & Bersten, A. (1986). Normeperidine toxicity. *Anesthesia and Analgesia*, 65, 536-538.

Atchison, N.E., Osgood, P.F., Carr, D.B., & Szyfelbein, S.K. (1991). Pain during burn dressing change in children: Relationship to burn area, depth, and analgesic regimens. *Pain*, 47, 41-46.

Bach, S., Noreng, M.F., & Tjellden, N.U. (1988). Phantom limb pain in amputees during the first 12 months following limb amputation, after preoperative lumbar epidural blockade. *Pain*, 33, 297-301.

Barrier, G., Attia, J., Mayer, M.N., Amiel-Tison, C., & Shnider, S.M. (1989). Measurement of post-operative pain and narcotic administration in infants using a new clinical scoring system. *Intensive Care Medicine*, 15, Suppl. 1, S37-S39.

Bauchner, H., Waring, C., & Vinci, R. (1991). Parental presence during procedures in an emergency room: Results from 50 observations. *Pediatrics*, 87, 544-548.

Bayer, A.J., Chada, J.S., Farag, R.R., & Pathy, M.S. (1986). Changing presentations of myocardial infarctions with increasing old age. *Journal of the American Geriatrics Society*, 34, 263-266.

Beecher, H.K. (1959). *Measurement of subjective responses: Quantitative effects of drugs.* New York: Oxford University Press.

Bellville, W.J., Forrest, W.H., Miller, E., & Brown, B.W. Jr. (1971). Influence of age on pain relief from analgesics. A study of postoperative patients. *Journal of the American Medical Association*, 217, 1835-1841.

Bender, J.S. (1989). Approach to the acute abdomen. *Medical Clinics of North America*, 73, 1413-1422.

Berde, C.B. (1989). Pediatric postoperative pain management. *Pediatric Clinics of North America*, 36, 921-940.

Berde, C.B. (1991). Pediatric analgesic trials. In Max, M.B., Portenoy, R.K., & Laska, E.M. (Eds.), *Advances in pain research and therapy: The design of analgesic clinical trials* (vol. 18, pp. 445-455). New York: Raven Press.

Berde, C.B., Lehn, B.M., Yee, J.D., Sethna, N.F., & Russo, D. (1991). Patient-controlled analgesia in children and adolescents: A randomized, prospective comparison with intramuscular administration of morphine for postoperative analgesia. *Journal of Pediatrics*, 118, 460-466.

Bernstein, N. (1963). Management of burned children with the aid of hypnosis. *Journal of Child Psychology and Psychiatry*, 4, 93-98.

Beyer, J.E. (1984). *The Oucher: A user's manual and technical report.* [Available from: Judith Beyer, University of Colorado, Denver, CO 80262.]

Beyer, J.E., DeGood, D.E., Ashley, L.C., & Russell, G.A. (1983). Patterns of postoperative analgesic use with adults and children following cardiac surgery. *Pain*, 17, 71-81.

Beyer, J.E., McGrath, P.J., & Berde, C.V. (1990). Discordance between self-report and behavioral pain measures in children age 3-7 years after surgery. *Journal of Pain and Symptom Management*, 5, 350-356.

Bollish, S.J., Collins, C.L., Kirking, D.M., & Bartlett, R.H. (1985). Efficacy of patient-controlled versus conventional analgesia for postoperative pain. *Clinical Pharmacy*, 4, 48-52.

Bray, R.J. (1983). Postoperative analgesia provided by morphine infusion in children. *Anaesthesia*, 38, 1075-1078.

Bromage, P.R., Campoersi, E., & Chestnut, D. (1980). Epidural narcotics for postoperative analgesia. *Anesthesia and Analgesia*, 59, 473-480.

Bullit, E. (1989). Induction of c-fos-like protein within the lumbar spinal cord and thalamus of the rat following peripheral stimulation. *Brain Research*, 493, 391-397.

Bush, J.P., Holmbeck, G.N., & Cockrell, J.L. (1989). Patterns of PRN analgesic drug administration in children following elective surgery. *Journal of Pediatric Psychology*, 14, 433-448.

Campbell, N.N., Reynolds, G.J., & Perkins, G. (1989). Postoperative analgesia in neonates: An Australia-wide survey. *Anaesthesia and Intensive Care*, 17, 487-499.

Campos, R.G. (1989). Soothing pain-elicited distress in infants with swaddling and pacifiers. *Child Development*, 60, 781-792.

Capogna, G., Celleno, D., Tagariello, V., & Loffreda-Mancinelli, C. (1988). Intrathecal buprenorphine for postoperative analgesia in the elderly patient. *Anaesthesia*, 43, 128-130.

Ceccio, C.M. (1984). Postoperative pain relief through relaxation in elderly patients with fractured hips. *Orthopedic Nursing*, 3, 11-19.

Chapman, C.R. & Syrjala, K.L. (1990). Measurement of pain. In Bonica, J.J. (Ed.), *The management of pain* (2nd ed., vol. 1, pp. 580-594). Philadelphia: Lea & Febiger.

Chawla, R., Arora, M.K., Saksena, R., & Gode, G.R. (1989). Efficacy and dose-response of intrathecal pentazocine for post-operative pain relief. *Indian Journal of Medical Research*, 90, 220-223.

Choiniere, M., Melzack, R., & Papillon, J. (1991). Pain and paresthesia in patients with healed burns: An exploratory study. *Journal of Pain and Symptom Management*, 6, 437-444.

Cohn, B.T., Draeger, R.I., & Jackson, D.W. (1989). The effects of cold therapy in the postoperative management of pain in patients undergoing anterior cruciate ligament reconstruction. *American Journal of Sports Medicine*, 17, 344-349.

Collins, C., Koren, G., Crean, P., Klein, J., Roy, W.L., & MacLeod, S.M. (1985). Fentanyl pharmacokinetics and hemodynamic effects in preterm infants during ligation of patent ductus arteriosus. *Anesthesia and Analgesia*, 64, 1078-1080.

Conn, I.G., Marshall, A.H., Yadav, S.N., Daly, J.C., & Jaffer, M. (1986). Transcutaneous electrical nerve stimulation following appendicectomy: The placebo effect. *Annals of the Royal College of Surgeons of England*, 68, 191-192.

Cooperman, A.M., Hall, B., Mikalacki, K., Hardy, R., & Sadar, E. (1977). Use of transcutaneous electrical stimulation in the control of postoperative pain. *American Journal of Surgery*, 133, 185-187.

Covington, E.C., Gonsalves-Ebrahim, L., Currie, K.O., Shepard, K.V., & Pippenger, C.E. (1988). Severe respiratory depression from patient-controlled analgesia in renal failure. *Psychosomatics*, 30, 226-228.

Crook, J., Rideout, E., & Browne, G. (1984). The prevalence of pain complaints in a general population. *Pain*, 18, 299-314.

Daake, D.R. & Gueldner, S.H. (1989). Imagery instruction and the control of postsurgical pain. *Applied Nursing Research*, 2, 114-120.

Danesh, B.J., Saniabadi, A.R., Russell, R.I., & Lowe, G.D. (1987). Therapeutic potential of choline magnesium trisalicylate as an alternative to aspirin for patients with bleeding tendencies. *Scottish Medical Journal*, 32, 167-168.

Daniels, L.K. (1976). The treatment of acute anxiety and postoperative gingival pain by hypnosis and covert conditioning: A case report. *American Journal of Clinical Hypnosis*, 19, 116-119.

Davie, I.T., Slawson, K.B., & Burt, R.A. (1982). A double-blind comparison of parenteral morphine, placebo, and oral fenoprofen in management of postoperative pain. *Anesthesia and Analgesia*, 61, 1002-1005.

Davies, J.R. (1982). Ineffective transcutaneous nerve stimulation following epidural anaesthesia. *Anaesthesia*, 37, 453-457.

Davis, M.A. (1988). Epidemiology of osteoarthritis. *Clinics in Geriatric Medicine*, 4, 241-255.

Dinarello, C. (1984). Interleukin-I. *Reviews of Infectious Diseases*, 6, 51-95.

Donovan, M., Dillon, P., & McGuire, L. (1987). Incidence and characteristics of pain in a sample of medical-surgical inpatients. *Pain*, 30, 69-78.

Dripps, R.D., Eckenhoff, J.E., & Vandam, L.D. (1982). *Introduction to anesthesia: The principles of safe practice*. Philadelphia: W.B. Saunders.

Egan, T.M., Herman, S.J., Doucette, E.J., Normand, S.L., & McLeod, R.S. (1988). A randomized, controlled trial to determine the effectiveness of fascial infiltration of bupivacaine in preventing respiratory complications after elective abdominal surgery. *Surgery*, 104, 734-740.

Egbert, A.M., Parks, L.H., Short, L.M., & Burnett, M.L. (1990). Randomized trial of postoperative patient controlled analgesia vs intramuscular narcotics in frail elderly men. *Archives of Internal Medicine*, 150, 1897-1903.

Egbert, L.D., Battit, G.E., Welch C.E., & Bartlett, M.K. (1964). Reduction of postoperative pain by encouragement and instruction of patients. *New England Journal of Medicine*, 270, 825-827.

Egdahl, G. (1959). Pituitary-adrenal response following trauma to the isolated leg. *Surgery*, 46, 9-21.

Eisenach, J.C., Grice, S.C., & Dewan, D.M. (1988). Patient-controlled analgesia following cesarean section: A comparison with epidural and intramuscular narcotics. *Anesthesiology*, 68, 444-448.

Eland, J.M. (1989). The effectiveness of transcutaneous electrical nerve stimulation (TENS) with children experiencing cancer pain. In Funk, S.G., Tornquist, E.M., Champagne, M.T., Copp, L.A., & Wiese, R.A. (Eds.), *Key aspects of comfort: Management of pain, fatigue, and nausea* (pp. 87-100). New York: Springer.

Eland, J.M. & Anderson, J.E. (1977). The experience of pain in children. In Jacox, A.K. (Ed.) *Pain: A source book for nurses and other health professionals* (pp. 453-473). Boston: Little, Brown.

Ellerton, M., Caty, S., & Ritchie, J. (1985). Helping young children master intrusive procedures through play. *Children's Health Care*, 13, 167-173.

Elliott, C.H. & Olson, R.A. (1983). The management of children's distress in response to painful medical treatment for burn injuries. *Behavioral Research and Therapy*, 21, 675-683.

Engberg, G. (1985a). Factors influencing the respiratory capacity after upper abdominal surgery. *Acta Anaesthesiologica Scandinavica*, 29, 434-445.

Engberg, G. (1985b). Respiratory performance after upper abdominal surgery: A comparison of pain relief with intercostal blocks and centrally acting analgesics. *Acta Anaesthesiologica Scandinavica*, 29, 427-433.

Estes, D. & Kaplan, K. (1980). Lack of platelet effect with the aspirin analog, salsalate. *Arthritis and Rheumatism*, 23, 1301-1307.

Evron, S., Schenker, J.G., Olshwang, D., Granat, M., & Magora, F. (1981). Postoperative analgesia by percutaneous electrical stimulation in gynecology and obstetrics. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*, 12, 305-313.

Facco, E., Manani, G., Angel, A., Vincenti, E., Tambuscio, B., Ceccherelli, F., Troletti, G., Ambrosio, F., & Giron, G.P. (1981). Comparison study between acupuncture and pentazocine analgesic and respiratory post-operative effects. *American Journal of Chinese Medicine*, 9, 225-235.

Fassler, D. (1985). The fear of needles in children. *American Journal of Orthopsychiatry*, 55, 371-377.

Ferguson, B.F. (1979). Preparing young children for hospitalization: A comparison of two methods. *Pediatrics*, 64, 656-664.

Fernald, C. & Corry, J. (1981). Empathic versus directive preparation of children for needles. *Child Health Care*, 10, 44-47.

Ferrante, F.M., Ostheimer, G.W., & Covino, B.G. (Eds.). (1990). *Patient-controlled analgesia*. Chicago: Blackwell.

Ferrell, B.A. (1991). Pain management in elderly people. *Journal of the American Geriatric Society*, 39, 64-73.

Ferrell, B.A., Ferrell, B.R., & Osterweil, D. (1990). Pain in the nursing home. *Journal of the American Geriatric Society*, 38, 409-414.

Field, T. & Goldson, E. (1984). Pacifying effects of nonnutritive sucking on term and preterm neonates during heelstick procedures. *Pediatrics*, 74, 1012-1015.

Fitzgerald, M. (1990). C-fos and changing the face of pain. *Trends in Neurosciences*, 13, 439-440.

Fitzgerald, M., Millard, C., & McIntosh, N. (1988). Hyperalgesia in premature infants. *Lancet*, 1, 292.

Fitzgerald, M., Millard, C., & McIntosh, N. (1989). Cutaneous hypersensitivity following peripheral tissue damage in newborn infants and its reversal with topical anesthesia. *Pain*, 39, 31-36.

Fitzgerald, M., Shaw, A., & MacIntosh, N. (1988). Postnatal development of the cutaneous flexor reflex: Comparative study of preterm infants and newborn rat pups. *Developmental Medicine and Child Neurology*, 30, 520-526.

Flaherty, G.G. & Fitzpatrick, J.J. (1978). Relaxation technique to increase comfort level of postoperative patients: A preliminary study. *Nursing Research*, 27, 352-355.

Foley, K.M. (1985). The treatment of cancer pain. *New England Journal of Medicine*, 313, 84-95.

Foley, K.M. & Inturrisi, C.E. (1987). Analgesic drug therapy in cancer pain: Principles and practice. *Medical Clinics of North America*, 71, 207-232.

Fordyce, W.E. (1978). Evaluating and managing chronic pain. *Geriatrics*, 33, 59-62.

Fortin, F. & Kirouac, S. (1976). A randomized controlled trial of preoperative patient education. *International Journal of Nursing Studies*, 13, 11-24.

Foster, R. & Hester, N. (1989). The relationship between assessment and pharmacologic intervention for pain in children. In Funk, S.G., Tornquist, E.M., Champagne, M.T., Copp, L.A., & Wiese, R.A. (Eds.), *Key aspects of comfort: Management of pain, fatigue, and nausea* (pp. 72-79). New York: Springer.

Foster, R.L. & Hester, N.O. (1990a). Administration of analgesics for children's pain. *Pain*, Suppl. 5, S27.

Foster, R.L. & Hester, N.O. (1990b). The relationship between pain ratings and pharmacologic interventions for children in pain. In Tyler, D. & Krane, E. (Eds.), *Advances in pain research and therapy: Pediatric pain* (vol. 15, pp. 31-36). New York: Raven Press.

Fowler-Kerry, S. (1990). Adolescent oncology survivors' recollection of pain. In Tyler, D. & Krane, E. (Eds.), *Advances in pain research and therapy: Pediatric pain* (vol. 15, pp. 365-371). New York: Raven Press.

Fowler-Kerry, S. & Lander, J.R. (1987). Management of injection pain in children. *Pain*, 30, 169-175.

Fradet, C., McGrath, P.J., Kay, J., Adams, S., & Luke, B. (1990). A prospective survey of reactions to blood tests by children and adolescents. *Pain*, 40, 53-60.

Franck, L.S. (1987). A national survey of the assessment and treatment of pain and agitation in the neonatal intensive care unit. *Journal of Obstetric, Gynecologic, and Neonatal Nursing*, 16, 387-393.

Fritz, D.J. (1988). Noninvasive pain control methods used by cancer outpatients (meeting abstract). *Oncology Nursing Forum*, Suppl. 108.

From the NIH. (1979). Pain in the elderly: Patterns change with age. *Journal of the American Medical Association*, 241, 2191-2192.

Gauvain-Piquard, A., Rodary, C., Rezvani, A., & Lemerle, J. (1987). Pain in children aged 2-6 years: A new observational rating scale elaborated in a pediatric oncology unit; A preliminary report. *Pain*, 31, 177-188.

Gedaly-Duff, V. & Ziebarth, D. (1991). Mothers' management of surgical pain in preschool children [abstract of paper presented at the Second International Symposium on Pediatric Pain]. *Journal of Pain and Symptom Management*, 6, 147.

Gracely, R.H. & Wolskee, P.J. (1983). Semantic functional measurement of pain: Integrating perception and language. *Pain*, 15, 389-398.

Grunau, R.V.E. & Craig, K.D. (1987). Pain expression in neonates: Facial action and cry. *Pain*, 28, 395-410.

Guideline report. Acute pain management: Operative or medical procedures and trauma (AHCPR Pub. No. 92-0022). (In press). Rockville, Md: Agency for Health Care Policy and Research.

Hanley, M.R. (1988). Proto-oncogenes in the nervous system. *Neuron*, 1, 175-182.

Hannallah, R.S. & Rosales, J.K. (1983). Experience with parents' presence during anaesthesia induction in children. *Canadian Anaesthetists' Society Journal*, 30, 286-289.

Hanson, A.L., Hanson, B., & Matousek, M. (1984). Epidural anesthesia for cesarean section. The effect of morphine-bupivacaine administered epidurally for intra- and postoperative pain relief. *Acta Obstetrica Gynecologica Scandinavica*, 63, 135-140.

Hansson, P. & Ekblom, A. (1986). Influence of stimulus frequency and probe size on vibration-induced alleviation of acute orofacial pain. *Applied Neurophysiology*, 49, 155-165.

Hargreaves, A. & Lander, J. (1989). Use of transcutaneous electrical nerve stimulation for postoperative pain. *Nursing Research*, 38, 159-161.

Hargreaves, K.M. & Dionne, R.A. (1991). Evaluating endogenous mediators of pain and analgesia in clinical studies. In Max, M., Portenoy, R., & Laska, E. (Eds.), *Advances in pain research and therapy. The design of analgesic clinical trials* (vol. 19, pp. 579-598). New York: Raven Press.

Harkins, S.W., Kwentus, J., & Price, D.D. (1984). Pain and the elderly. In Benedetti, C., Chapman, C., & Moricca, G. (Eds.), *Advances in pain research and therapy. Recent advances in the management of pain* (vol. 7, pp. 103-121). New York: Raven Press.

Hasenbos, M., van Egmond, J., Gielen, M., & Crul, J.F. (1987). Post-operative analgesia by high thoracic epidural versus intramuscular nicomorphine after thoracotomy. Part III. The effects of pre- and post-operative analgesia on morbidity. *Acta Anaesthesiologica Scandinavica*, 31, 608-615.

Hasselstrom, Eriksson, S., Persson A., Rane, A., Svensson, J.O., & Sawa, J. (1990). The metabolism and bioavailability of morphine in patients with severe liver cirrhosis. *British Journal of Clinical Pharmacology*, 29, 289-297.

Hendrickson, M., Myre, L., Johnson, D.G., Matlak, M.E., Black, R.E., & Sullivan, J.J. (1990). Postoperative analgesia in children: A prospective study of intermittent intramuscular injections versus continuous intravenous infusion of morphine. *Journal of Pediatric Surgery*, 25, 185-191.

Hertzka, R., Gauntlett, I., Fisher, D., & Spellman, M. (1989). Fentanyl-induced ventilatory depression: Effects of age. *Anesthesiology*, 70, 213-218.

Hester, N.K.O. (1979). The preoperational child's reaction to immunization. *Nursing Research*, 28, 250-255.

Hester, N.O. (1989). Comforting the child in pain. In Funk, S.G., Tornquist, E.M., Champagne, M.T., Copp, L.A., & Wiese, R.A. (Eds.), *Key aspects of comfort: Management of pain, fatigue, and nausea* (pp. 290-298). New York: Springer.

Hester, N.O. & Barcus, C.S. (1986). Assessment and management of pain in children. *Pediatrics: Nursing Update*, 1, 1-8.

Hester, N.O. & Foster, R.L. (1990). Cues nurses and parents use in making judgments about children's pain. *Pain*, Suppl. 5, S31.

Hester, N. O., Foster, R. L., & Kristensen, K. (1990). Measurement of pain in children: Generalizability and validity of the Pain Ladder and the Poker Chip tool. In Tyler, D.C. & Krane, E.J. (Eds.), *Advances in pain research and therapy: Pediatric pain* (vol. 15, pp. 79-84). New York: Raven Press.

Hester, N.O., Foster, R., Kristensen, K., & Bergstrom, L. (1989). *Measurement of children's pain by children, parents, and nurses: Psychometric and clinical issues related to the poker chip tool and the pain ladder. Generalizability of procedures assessing pain in children: Final report.* Research funded by NIH, National Center for Nursing Research under Grant Number NR01382. [Available from N.O. Hester, Center for Nursing Research, School of Nursing, University of Colorado, Denver, CO 80262.]

Hewlett, A.M. & Branthwaite, M.A. (1975). Postoperative pulmonary function. *British Journal of Anaesthesia*, 47, 102-107.

Hodsman, N.B., Burns, J., Blyth, A., Kenny, G.N., McArdle, C.S., & Rotman, H. (1987). The morphine sparing effects of diclofenac sodium following abdominal surgery. *Anaesthesia*, 42, 1005-1008.

Horan, J.J., Laying, F.C., & Pursell, C.H. (1976). Preliminary study of effects of "in vivo" emotive imagery on dental discomfort. *Perceptual and Motor Skills*, 42, 105-106.

Horowitz, B.F., Fitzpatrick, J.J., & Flaherty, G.G. (1984). Relaxation techniques for pain relief after open heart surgery. *Dimensions in Critical Care Nursing*, 3, 364-371.

Houde, R.W. (1982). Methods for measuring clinical pain in humans. *Acta Anaesthesiologica Scandinavica*, 74 (Suppl), 25-29.

Hunt, S.P., Pini, A., & Evan, G. (1987). Induction of c-fos-like protein in spinal cord neurons following sensory stimulation. *Nature*, 328, 632-634.

International Association for the Study of Pain. (1979). Pain terms: A list with definitions and notes on usage. *Pain*, 6, 249.

International Association for the Study of Pain. (In press). *Report of the task force on acute pain management.*

Jackson, D. (1989). A study of pain management: Patient controlled analgesia versus intramuscular analgesia. *Journal of Intravenous Nursing*, 12, 42-51.

Jackson, D.L., Moore, P.A., & Hargreaves, K.M. (1989). Pre-operative nonsteroidal anti-inflammatory medication for the prevention of postoperative dental pain. *Journal of the American Dental Association*, 119, 641-647.

Jacox, A.K. (Ed.). (1977). *Pain: A sourcebook for nurses and other health professionals.* Boston: Little, Brown.

Jay, S.M., Elliot, C., Ozolins, M., Olson, R., & Pruitt, S. (1985). Behavioral management of children's distress during painful medical procedures. *Behavioral Research and Therapy*, 23, 513-520.

Jay, S.M., Ozolins, M., Elliott, C.H., & Caldwell, S. (1983). Assessment of children's distress during painful medical procedures. *Health Psychology*, 2, 133-147.

Jensen, J.E., Conn, R.R., Hazelrigg, G., & Hewett, J.E. (1985). The use of transcutaneous neural stimulation and isokinetic testing in arthroscopic knee surgery. *American Journal of Sports Medicine*, 13, 27-33.

John, M.E. Jr. & Parrino, J.P. (1983). Practical hypnotic suggestion in ophthalmic surgery. *American Journal of Ophthalmology*, 96, 540-542.

Johnson, J., Fuller, S., Endress, P., & Rice, V. (1978). Altering patients' responses to surgery: An extension and replication. *Research in Nursing and Health*, 1, 111-121.

Johnson, J., Rice, V., Fuller, S., & Endress, P. (1978). Sensory information, instruction in a coping strategy, and recovery from surgery. *Research in Nursing and Health*, 1, 4-17.

Johnson, J.E., Kirchoff, K., & Endress, M.P. (1975). Altering children's distress behavior during orthopedic cast removal. *Nursing Research*, 24, 404-410.

Johnston, C.C., Bevan, J.C., Haig, M.J., Kirnon, V., & Tousignant, G. (1988). Parental presence during anesthesia induction. *Association of Operating Room Nurses Journal*, 47, 187-194.

Johnston, C.C., Jeans, M.E., Abbott, F.V., Grey-Donald, K., & Edgar, L. (1988). A survey of pain in hospitalized children: Preliminary results [abstract, p. 80]. In Tyler, D. & Krane, E. (Chairs), *Proceedings of the 1st International Symposium on Pediatric Pain.* New York: Raven Press.

Jönsson, A., Cassuto, J., & Hanson, B. (1991). Inhibition of burn pain by intravenous lignocaine infusion. *Lancet*, 338, 151-152.

Kaiko, R.F. (1980). Age and morphine analgesia in cancer patients with post-operative pain. *Clinical Pharmacology Therapeutics*, 28, 823-826.

Kaiko, R.F., Foley, K.M., Grabinski, P.Y., Heidrich, G., Rogers, A.G., Inturissi, C.E., & Reidenberg M.M. (1983). Central nervous system excitatory effects of meperidine in cancer patients. *Annals of Neurology*, 13, 180-185.

Kaiko, R.F., Wallenstein, S.L., Rogers, A.G., Grabinski, P.Y., & Houde, R.W. (1982). Narcotics in the elderly. *Medical Clinics of North America*, 66, 1079-1089.

Kallos, T. & Caruso, F.S. (1979). Respiratory effects of butorphanol and pethidine. *Anaesthesia*, 34, 633-637.

Kane, R.L., Ouslander, J.G., & Abrass, I.B. (Eds.). (1989). *Essentials of clinical geriatrics* (2nd ed.). New York: McGraw-Hill.

Kaplan, J.A., Miller, E.D. Jr., & Gallagher, E.G. Jr. (1975). Postoperative analgesia for thoracotomy patients. *Anesthesia and Analgesia*, 54, 773-777.

Katz, E.R., Kellerman, J., & Siegel, S.E. (1980). Behavioral distress in children with cancer undergoing medical procedures: Developmental considerations. *Journal of Consulting and Clinical Psychology*, 48, 356-365.

Kavanagh, C. (1983a). A new approach to dressing change in the severely burned child and its effects on burn-related psychopathology. *Heart and Lung*, 12, 612-619.

Kavanagh, C. (1983b). Psychological intervention with the severely burned child: Report of an experimental comparison of two approaches and their effects on psychological sequelae. *Journal of the American Academy of Child Psychiatry*, 22, 145-156.

Kehlet, H. (1982). The endocrine-metabolic response to postoperative pain. *Acta Anaesthesiologica Scandinavica*, 74 (Suppl), 173-175.

Kehlet, H. (1989a). Postoperative pain. In Committee on Pre- and Postoperative Care, American College of Surgeons, *Care of the surgical patient* (vol. 1, pp. 3-12). New York: Scientific American Medicine.

Kehlet, H. (1989b). Surgical stress: The role of pain and analgesia. *British Journal of Anaesthesia*, 63, 189-195.

Kehlet, H., Brandt, M.R., & Rem, J. (1980). Role of neurogenic stimuli in mediating the endocrine-metabolic response to surgery. *Journal of Parenteral & Enteral Nutrition*, 4, 152-156.

Kelley, M.L., Jarvie, G.J., Middlebrook, J.L., McNeer, M.F., & Drabman, R.S. (1984). Decreasing burned children's pain behavior: Impacting the trauma of hydrotherapy. *Journal of Applied Behavioral Analysis*, 17, 147-158.

Kiefer, R.C. & Hospodarsky, J. (1980). The use of hypnotic technique in anesthesia to decrease postoperative meperidine requirements. *Journal of the American Osteopathic Association*, 79, 693-695.

Koehntop, D., Rodman, J., Brundage, D., Hegland, M., & Buckley, J. (1986). Pharmacokinetics of fentanyl in neonates. *Anesthesia and Analgesia*, 65, 227-232.

Koren, G., Butt, W., Chinyanga, H., Soldin, S., & Pape, K. (1985). Postoperative morphine infusion in newborn infants: Assessment of disposition characteristics and safety. *Journal of Pediatrics*, 107, 963-967.

Lanham, R.H. Jr., Powell, S., & Hendrix, B.E. (1984). Efficacy of hypothermia and transcutaneous electrical nerve stimulation in podiatric surgery. *Journal of Foot Surgery*, 23, 152-158.

Latimer, R.G., Dickman, M., Day, W.C., Gunn, M.L., & Schmidt, C.D. (1971). Ventilatory patterns and pulmonary complications after upper abdominal surgery determined by preoperative and postoperative computerized spirometry and blood gas analysis. *American Journal of Surgery*, 122, 622-632.

Lawlis, G.F., Selby, D., Hinnant, D., & McCoy, C.E. (1985). Reduction of postoperative pain parameters by presurgical relaxation instructions for spinal pain patients. *Spine*, 10, 649-651.

LeBaron, S. & Zeltzer, L. (1984). Assessment of acute pain and anxiety in children and adolescents by self-reports, observer reports, and a behavior checklist. *Journal of Consulting and Clinical Psychology*, 52, 729-738.

Lee, M., Itoh, M., Yang, G.W., & Eason, A.L. (1990). Physical therapy and rehabilitation medicine. In Bonica, J.J. (Ed.), *The management of pain* (2nd ed., vol. 2, pp. 1769-1788). Philadelphia: Lea & Febiger.

Levin, R.F., Malloy, G.B., & Hyman, R.B. (1987). Nursing management of postoperative pain: Use of relaxation techniques with female cholecystectomy patients. *Journal of Advanced Nursing*, 12, 463-472.

Liu, Y.C., Liao, W.S., & Lien, I.N. (1985). Effect of transcutaneous electrical nerve stimulation for post-thoracotomic pain. *Journal of the Formosan Medical Association*, 84, 801-809.

Locsin, R.G. (1981). The effect of music on the pain of selected post-operative patients. *Journal of Advanced Nursing*, 6, 19-25.

Lynn, A.M., Opheim, K.E., & Tyler, D.C. (1984). Morphine infusion after pediatric cardiac surgery. *Critical Care Medicine*, 12, 863-866.

Lynn, A.M. & Slattery, J.T. (1987). Morphine pharmacokinetics in early infancy. *Anesthesiology*, 66, 136-139.

Madden, C., Singer, G., Peck, C., & Nayman, J. (1978). The effect of EMG biofeedback on postoperative pain following abdominal surgery. *Anaesthesia and Intensive Care*, 6, 333-336.

Marks, R.M. & Sachar, E.J. (1973). Undertreatment of medical inpatients with narcotic analgesics. *Annals of Internal Medicine*, 78, 173-181.

Marshall, B.E. & Wyche, M.Q. Jr. (1972). Hypoxemia during and after anesthesia. *Anesthesiology*, 37, 178-209.

Martens, M. (1982). A significant decrease of narcotic drug dosage after orthopaedic surgery. A double-blind study with naproxen. *Acta Orthopaedica Belgica*, 48, 900-906.

Mather, L. & Mackie, J. (1983). The incidence of postoperative pain in children. *Pain*, 15, 271-282.

Maunuksela, E.L. & Korpela, R. (1986). Double-blind evaluation of a lignocaine-prilocaine cream (EMLA) in children. *British Journal of Anaesthesia*, 58, 1242-1245.

Max, M.B., Inturrisi, C.E., Kaiko, R.F., Grabinski, P.Y., Li, C.H., & Foley, K.M. (1985). Epidural and intrathecal opiates: Cerebrospinal fluid and plasma profiles in patients with chronic cancer pain. *Clinical Pharmacology and Therapeutics*, 38, 631-641.

Maxwell, L., Yaster, M., Wetzel, R., & Niebyl, J. (1987). Penile nerve block for newborn circumcision. *Obstetrics and Gynecology*, 70, 415-419.

McCaffery, M. & Beebe, A. (1989). *Pain: Clinical manual for nursing practice*. St. Louis: C.V. Mosby.

McGrath, D., Thurston, N., Wright, D., Preshaw, R., & Fermin, P. (1989). Comparison of one technique of patient-controlled postoperative analgesia with intramuscular meperidine. *Pain*, 37, 265-270.

McGrath, M.M. (1979). Group preparation of pediatric surgical patients. *Image*, 11, 52-62.

McGrath, P.A. (1990). *Pain in children: Nature, assessment, and treatment*. New York: Guilford Press.

McGrath, P.A., de Veber, L.L., & Hearn, M.T. (1985). Multidimensional pain assessment in children. In Fields, H.L., Dubner, R., & Cervero, F. (Eds.), *Proceedings of the Fourth World Conference on Pain. Advances in pain research and therapy* (vol. 9, pp. 387-393). New York: Raven Press.

McGrath, P.J., Johnson, G., Goodman, J.T., Schillinger, J., Dunn, J., & Chapman, J. (1985). CHEOPS: A behavioral scale for rating postoperative pain in children. In Fields, H.L., Dubner, R., & Cervero, F. (Eds.), *Proceedings of the Fourth World Conference on Pain. Advances in pain research and therapy* (vol. 9, pp. 395-402). New York: Raven Press.

McGrath, P.J. & Unruh, A.M. (1987). *Pain in children and adolescents*. Amsterdam: Elsevier.

McQuay, H. (1989). Opioids in chronic pain. *British Journal of Anaesthesia*, 63, 213-226.

McQuay, H.J., Carroll, D., & Moore, R.A. (1988). Postoperative orthopaedic pain: The effect of opiate premedication and local anaesthetic blocks. *Pain*, 33, 291-295.

Meignier, M., Souron, R., & LeNeel, J.C. (1983). Postoperative dorsal epidural analgesia in the child with respiratory disabilities. *Anesthesiology*, 59, 473-475.

Merskey, H. (1964). *An investigation of pain in psychological illness*. D.M. Thesis, Oxford.

Modig, J., Borg, T., Bagge, L., & Saldeen, T. (1983). Role of extradural and of general anaesthesia in fibrinolysis and coagulation after total hip replacement. *British Journal of Anaesthesia*, 55, 625-629.

Modig, J., Borg, T., Karlstrom, G., Maripuu, E., & Sahlstedt, B. (1983). Thromboembolism after total hip replacement: Role of epidural and general anesthesia. *Anesthesia and Analgesia*, 62, 174-180.

Mogan, J., Wells, N., & Robertson, E. (1985). Effects of preoperative teaching on postoperative pain: A replication and expansion. *International Journal of Nursing Studies*, 22, 267-280.

Moon, M.H. & Gibbs, J.M. (1984). The control of postoperative pain by EMG biofeedback in patients undergoing hysterectomy. *New Zealand Medical Journal*, 97, 643-646.

Mullooly, V.M., Levin, R.F., & Feldman, H.R. (1988). Music for postoperative pain and anxiety. *Journal of the NY State Nurses Association*, 19, 4-7.

Nagashima, H., Karamanian, A., Malovany, R., Radnay, P., Ang, M., Koerner, S., & Foldes, F.F. (1976). Respiratory and circulatory effects of intravenous butorphanol and morphine. *Clinical Pharmacology and Therapeutics*, 19, 738-745.

Nahata, M., Clotz, M., & Krogg, E. (1985). Adverse effects of meperidine, promethazine, and chlorpromazine for sedation in pediatric patients. *Clinical Pediatrics*, 24, 558-560.

National Health and Medical Research Council [Australia]. (1988). *Management of severe pain*. Canberra, Australia: National Health and Medical Research Council.

National Institutes of Health. (1987). The integrated approach to the management of pain. *Journal of Pain and Symptom Management*, 2, 35-44.

Neary, J. (1981). Transcutaneous electrical nerve stimulation for the relief of post-incisional surgical pain. *Journal of the American Association of Nurse Anesthetists*, 149, 151-155.

Oden, R. (1989). Acute postoperative pain: Incidence, severity, and the etiology of inadequate treatment. *Anesthesiology Clinics of North America*, 7, 1-15.

Olness, K. (1981). Imagery (self-hypnosis) as adjunct therapy in childhood cancer: Clinical experience with 25 patients. *The American Journal of Pediatric Hematology/Oncology*, 3, 313-321.

Patel, J.M., Lanzafame, R.J., Williams, J.S., Mullen, B.V., & Hinshaw, J.R. (1983). The effect of incisional infiltration of bupivacaine hydrochloride upon pulmonary functions, atelectasis, and narcotic need following elective cholecystectomy. *Surgery, Gynecology and Obstetrics*, 157, 338-340.

Peebles, R.J. & Schneidman, D.S. (1991). *Socio-Economic Factbook for Surgery, 1991-92*. Chicago: American College of Surgeons.

Pettine, K.A., Wedel, D.J., Cabanela, M.E., & Weeks, J.L. (1989). The use of epidural bupivacaine following total knee arthroplasty. *Orthopedic Review*, 18, 894-901.

Phillips, G.D. & Cousins, M.J. (1986). Practical decision making. In Cousins, J.M. & Phillips, G.D. (Eds.), *Acute pain management* (pp. 275-290). New York: Churchill Livingstone.

Pickett, C. & Clum, G.A. (1982). Comparative treatment strategies and their interaction with locus of control in the reduction of postsurgical pain and anxiety. *Journal of Consulting and Clinical Psychology*, 50, 439-441.

Portenoy, R.K. & Payne, R. (In press). Acute and chronic pain. In Lowinson, J.H., Ruit, P., Milman, R., & Langvod, J. (Eds.), *Comprehensive textbook of substance abuse*. Baltimore: Williams and Wilkins.

Porter, J. & Jick, H. (1980). Addiction rare in patients treated with narcotics [letter]. *New England Journal of Medicine*, 302, 123.

Przewlocki, R., Haarmann, I., Nikolarakis, K., Herz, A., & Hollt, V. (1988). Prodynorphin gene expression in spinal cord is enhanced after traumatic injury in the rat. *Brain Research*, 464, 37-41.

Purcell-Jones, G., Dormon, F., & Sumner, E. (1987). The use of opioids in neonates. A retrospective study of 933 cases. *Anaesthesia*, 42, 1316-1320.

Purcell-Jones, G., Dormon, F., & Sumner, E. (1988). Paediatric anaesthetists' perceptions of neonatal and infant pain. *Pain*, 33, 181-187.

Pybus, D.A., D'Bras, B.E., Goulding, G., Liberman, H., & Torda, T.A. (1983). Postoperative analgesia for haemorrhoid surgery. *Anaesthesia and Intensive Care*, 11, 27-30.

Quay, N.B. & Alexander, L.L. (1983). Preparation of burned children and their families for discharge. *The Journal of Burn Care and Rehabilitation*, 4, 288-290.

Rawal, N. & Sjostrand U.H. (1986). Clinical application of epidural and intrathecal opioids for pain management. *International Anesthesiology Clinics*, 24, 43-57.

Reading, A.E. (1982). The effects of psychological preparation on pain and recovery after minor gynecological surgery: A preliminary report. *Journal of Clinical Psychology*, 38, 504-512.

Ready, L.B., Oden, R., Chadwick, H.S., Bendetti, C., Rooke, G.A., Caplan, R., & Wild, L.M. (1988). Development of an anesthesiology-based postoperative pain service. *Anesthesiology*, 68, 100-106.

Reay, B.A., Semple, A.J., Macrae, W.A., MacKenzie, N., & Grant, I.S. (1989). Low-dose intrathecal diamorphine analgesia following major orthopaedic surgery. *British Journal of Anaesthesia*, 62, 248-252.

Rooney, S.M., Jain, S., McCormack, P., Bains, M., Martini, N., & Goldiner, P. (1986). A comparison of pulmonary function tests for postthoracotomy pain using cryoanalgesia and transcutaneous nerve stimulation. *The Annals of Thoracic Surgery*, 41, 204-207.

Rosen, H., Absi, E.G., & Webster, J.A. (1985). Suprofen compared to dextropropoxyphene hydrochloride and paracetamol (Cosalgesic) after extraction of wisdom teeth under general anesthesia. *Anaesthesia*, 40, 639-641.

Ross, D.M. (1984). Thought-stopping: A coping strategy for impending feared events. *Issues in Comprehensive Pediatric Nursing*, 7, 83-89.

Roth, S.H. (1989). Merits and liabilities of NSAID therapy. *Rheumatic Diseases Clinics of North America*, 15, 479-498.

Royal College of Surgeons of England, the College of Anesthetists. (1990). *Report of the Working Party on Pain After Surgery*. London: Royal College of Surgeons.

Ryan, E. (1989). The effect of musical distraction on pain in hospitalized school-aged children. In Funk, W., Tournquist, E., Champagne, M., Copp, L., & Wiese, R. (Eds.), *Key aspects of comfort: Management of pain, fatigue, and nausea* (pp. 101-104). New York: Springer.

Sabanathan, S., Mearns, A.J., Bickford Smith, P.J., Eng, J., Berrisford, R.G., Bibby, S.R., & Majid, M.R. (1990). Efficacy of continuous extrapleural intercostal nerve block on post-thoracotomy pain and pulmonary mechanics. *British Journal of Surgery*, 77, 221-225.

Savedra, M., Gibbons, P., Tesler, M., Ward, J., & Wegner, C. (1982). How do children describe pain? A tentative assessment. *Pain*, 14, 95-104.

Savedra, M.C., Tesler, M.D., Holzemer, W.L., & Ward, J.A. (1989). *Adolescent Pediatric Pain Tool (APPT) preliminary user's manual*. San Francisco: University of California. [Available from M.C. Savedra, UCSF School of Nursing, San Francisco, CA 94143-0606.]

Schechter, N.L. (1989). The undertreatment of pain in children: An overview. *Pediatric Clinics of North America*, 36, 781-794.

Schechter, N.L. & Allen, D.A. (1986). Physician's attitudes toward pain in children. *Journal of Developmental and Behavioral Pediatrics*, 7, 350-354.

Schechter, N.L., Bernstein, B.A., Beck, A., Hart, L., & Sherzer, L. (1991). Individual differences in children's response to pain: Role of temperament and parental characteristics. *Pediatrics*, 87, 171-177.

Schmitt, F. & Wooldridge, P.J. (1973). Psychological preparation of surgical patients. *Nursing Research*, 22, 108-116.

Schnurrer, J.A., Marvin, J.A., & Heimbach, D.M. (1985). Evaluation of pediatric pain medications. *Journal of Burn Care and Rehabilitation*, 6, 105-107.

Schofield, N. & White, J. (1989). Interrelations among children, parents, premedication, and anaesthetists in paediatric day stay surgery. *British Medical Journal*, 299, 1371-1375.

Scott, J. & Huskisson, E.C. (1976). Graphic representation of pain. *Pain*, 2, 175-184.

Scott, N.B., Mogensen, T., Bigler, D., & Kehlet, H. (1989). Comparison of the effects of continuous intrapleural vs epidural administration of 0.5% bupivacaine on pain, metabolic response and pulmonary function following cholecystectomy. *Acta Anaesthesiologica Scandinavica*, 33, 535-539.

Sear, J.W., Hand, C.W., Moore, R.A., & McQuay, H.J. (1989). Studies on morphine disposition: Influence of renal failure on the kinetics of morphine and its metabolites. *British Journal of Anaesthesia*, 62, 28-32.

Shaw, E. & Routh, D. (1982). Effect of mothers' presence on children's reaction to aversive procedures. *Journal of Pediatric Psychology*, 7, 33-42.

Shulman, M., Sandler, A.N., Bradley, J.W., Young, P.S., & Brebner, J. (1984). Postthoracotomy pain and pulmonary function following epidural and systemic morphine. *Anesthesiology*, 61, 569-575.

Siegel, L. & Peterson, L. (1980). Stress reduction in young dental patients through coping skills and sensory information. *Journal of Consulting and Clinical Psychology*, 48, 785-787.

Siegel, L. & Peterson, L. (1981). Maintenance effects of coping skills and sensory information on young children's response to repeated dental procedures. *Behavior Therapy*, 12, 530-535.

Sjøgren, P. & Banning, A. (1989). Pain, sedation, and reaction time during long-term treatment of cancer patients with oral and epidural opioids. *Pain*, 39, 5-11.

Skacel, P.O., Hewlett, A.M., Lewis, J.D., Lamb, M., Nunn, J.F., & Chanarin, I. (1983). Studies on the haemopoetic toxicity of nitrous oxide in man. *British Journal of Haematology*, 53, 189-200.

Smith, C.M., Guralnick, M.S., Gelfand, M.M., & Jeans, M.E. (1986). The effects of transcutaneous electrical nerve stimulation on post-cesarean pain. *Pain*, 27, 181-193.

Smith, M.J., Hutchins, R.C., & Hehenberger, D. (1983). Transcutaneous neural stimulation use in postoperative knee rehabilitation. *American Journal of Sports Medicine*, 11, 75-82.

Snow, B.R. (1985). The use of hypnosis in the management of preoperative anxiety and postoperative pain in a patient undergoing laminectomy. *Bulletin of the Hospital for Joint Disease Orthopaedic Institute*, 45, 143-149.

Soderstrom, C.A., Trifillis, A.L., Shankar, B.S., Clark, W.E., & Cowley, R.A. (1988). Marijuana and alcohol use among 1023 trauma patients. A prospective study. *Archives of Surgery*, 123, 733-777.

Solomon, R., Viernstein, M., & Long, D. (1980). Reduction of postoperative pain and narcotic use by transcutaneous electrical nerve stimulation. *Surgery*, 87, 142-146.

Sriwatanakul, K., Kelvie, W., & Lasagna, L. (1982). The quantification of pain: An analysis of words used to describe pain and analgesia in clinical trials. *Clinical Pharmacology and Therapeutics*, 32, 143-148.

Sriwatanakul, K., Kelvie, W., Lasagna, L., Calimlim, J., Weis, O., & Mehta, G. (1983). Studies with different types of visual analog scales for measurement of pain. *Clinical Pharmacology and Therapeutics*, 34, 234-239.

Sriwatanakul, K., Weis, O.F., Alloza, J.L., Kelvie, W., Weintraub, M., & Lasagna, L. (1983). Analysis of narcotic usage in the treatment of postoperative pain. *Journal of the American Medical Association*, 250, 926-929.

Stevens, B. (1990). Development and testing of a pediatric pain management sheet. *Pediatric Nursing*, 16, 543-548.

Swinford, P. (1987). Relaxation and positive imagery for the surgical patient: A research study. *Perioperative Nursing Quarterly*, 3, 9-16.

Sydow, F.W. (1989). The influence of anesthesia and postoperative analgesic management on lung function. *Acta Chiurgica Scandinavica*, 550 (Suppl), 159-165.

Syrjala, K.L. (1990). Relaxation techniques. In Bonica, J.J. (Ed.), *The management of pain* (vol. 2, pp. 1742-1750). Philadelphia: Lea & Febiger.

Szeto, H., Inturrisi, C., Houde, R., Saal, S., Cheigh, J., & Reidenberg, M.M. (1977). Accumulation of normeperidine, an active metabolite of meperidine, in patients with renal failure of cancer. *Annals of Internal Medicine*, 86, 738-741.

Taylor, A.G., West, B.A., Simon, B., Skelton, J., & Rowlingson, J.C. (1983). How effective is TENS for acute pain? *American Journal of Nursing*, 83, 1171-1174.

Tesler, M.D., Savedra, M.C., Holzemer, W.L., Wilkie, D.J., Ward, J.A., & Paul, S.M. (1991). The word-graphic rating scale as a measure of children's and adolescents' pain intensity. *Research in Nursing and Health*, 14, 361-371.

Toledo-Pereyra, L.H. & DeMeester, T.R. (1979). Prospective randomized evaluation of intrathoracic intercostal nerve block with bupivacaine on postoperative ventilatory function. *The Annals of Thoracic Surgery*, 27, 203-205.

Tree-Trakarn, T., Pirayavaraporn, S., & Lertakyamanee, J. (1987). Topical analgesia for relief of post-circumcision pain. *Anesthesiology*, 67, 395-399.

Triplett, J.L. & Arneson, S.W. (1979). The use of verbal and tactile comfort to alleviate distress in young hospitalized children. *Research in Nursing and Health*, 2, 17-23.

Van Aernam, B. & Lindeman, C. (1971). Nursing intervention with the presurgical patient: The effects of structured and unstructured preoperative teaching. *Nursing Research*, 20, 319-332.

VanderArk, G. & McGrath, K. (1975). Transcutaneous electrical stimulation in treatment of postoperative pain. *The American Journal of Surgery*, 130, 338-340.

Ventafridda, V., Ripamonti, C., DeConno, F., Bianchi, M., Pazzuconi, F., & Panerai, A.E. (1987). Antidepressants increase bioavailability of morphine in cancer patients (Letter to the Editor). *Lancet*, 1, 1204.

Visintainer, M. & Wolfer, J. (1975). Psychological preparation for surgical pediatric patients: The effects on children's and parents' stress responses and adjustment. *Pediatrics*, 56, 187-202.

Voshall, B. (1980). The effects of preoperative teaching on postoperative pain. *Topics in Clinical Nursing*, 2, 39-43.

Wall, P.D. (1988). The prevention of postoperative pain. *Pain*, 33, 289-290.

Warfield, C., Stein, J., & Frank, H. (1985). The effect of transcutaneous electrical nerve stimulation on pain after thoracotomy. *The Annals of Thoracic Surgery*, 39, 462-465.

Wasylak, T.J., Abbott, F.V., English, M.J., & Jeans, M.E. (1990). Reduction of post-operative morbidity following patient-controlled morphine. *Canadian Journal of Anaesthesia*, 37, 726-731.

Wattwil, M. (1989). Postoperative pain relief and gastrointestinal motility. *Acta Chiurgica Scandinavica*, 550 (Suppl), 140-145.

Way, W.L., Costley, E.C., & Way, E.L. (1965). Respiratory sensitivity of the newborn infant to meperidine and morphine. *Clinical Pharmacology and Therapeutics*, 6, 454-461.

Weekes, D. & Savedra, M. (1988). Adolescent cancer: Coping with treatment-related pain. *Journal of Pediatric Nursing*, 3, 318-328.

Weissman, D.E. & Haddox, J.D. (1989). Opioid pseudoaddiction: An iatrogenic syndrome. *Pain*, 36, 363-366.

Wells, N. (1982). The effect of relaxation on postoperative muscle tension and pain. *Nursing Research*, 31, 236-238.

Wigram, J.R., Lewith, G.T., Machin, D., & Church, J.J. (1986). Electroacupuncture for postoperative pain. *Physiotherapy Practice*, 2, 83-88.

Wolfer, J. & Visintainer, M. (1979). Prehospital psychological preparation for tonsillectomy patients: Effects on children's and parents' adjustment. *Pediatrics*, 64, 646-655.

Wood, M.M. & Cousins, M.J. (1989). Iatrogenic neurotoxicity in cancer patients. *Pain*, 39, 1-3.

Woolf, C.J. & Wall, P.D. (1986). Morphine-sensitive and morphine-insensitive actions of C-fibre input on the rat spinal cord. *Neuroscience Letters*, 64, 221-225.

Yaster, M. (1987). The dose response of fentanyl in neonatal anesthesia. *Anesthesiology*, 66, 433-435.

Zeltzer, L.K., Altman, A., Cohen, D., LeBaron, S., Maunuksela, E.L., & Schechter, N.L. (1990). American Academy of Pediatrics: Report of the Subcommittee on Management of Pain Associated with Procedures in Children with Cancer. *Pediatrics*, 86, Suppl. 5, 826-831.

Zeltzer, L.K., Jay, S.M., & Fisher, D.M. (1989). The management of pain associated with pediatric procedures. *Pediatric Clinics of North America*, 36, 941-964.

Zeltzer, L. & LeBaron, S. (1982). Hypnosis and nonhypnotic techniques for reduction of pain and anxiety during painful procedures in children and adolescents with cancer. *Journal of Pediatrics*, 101, 1032-1035.

Glossary

General Terms

AHCPR: Agency for Health Care Policy and Research; Federal agency established in 1989.

Best evidence synthesis: Evidence based on the best evidence principle as used in law, in which the same evidence that would be essential in one case might be disregarded in a second case because better evidence becomes available.

Case study design: A nonexperimental study that extensively explores a single unit (a unit may be a person, family, or group) or a very small number of units.

Descriptive study: A nonexperimental study in which variables or subject characteristics are examined as they naturally occur for the purpose of describing or comparing samples or examining relationships among a set of variables.

Experimental study: (Randomized controlled trial or randomized clinical trial) An experiment that uses random assignment to create treatment and control groups so that changes can be inferred or attributed to the experimental treatment.

Meta-analysis: The process of combining the results of several related studies to obtain more reliable conclusions.

Peer review: Evaluation of the present guideline document by an interdisciplinary panel of experts using the Institute of Medicine (Field and Lohr, 1990) attributes of clinical practice guidelines as evaluation criteria.

Pilot review: Review and testing of the present guideline by clinicians to evaluate aspects of the guideline such as clarity, clinical applicability, flexibility, resource utilization, training needs, and cost of guideline implementation. Review of a consumer version of the present guideline by consumers and clinicians to evaluate its clarity, usefulness, flexibility, and accuracy.

Quasi-experimental study: (Includes nonrandomized controlled trial or nonrandomized clinical trial) A design that does not use random assignment to create treatment and control groups but uses other methods to control validity threats so that changes can be inferred or attributed to the experimental treatment.

Scientific review: An exhaustive literature search to define and critically evaluate the knowledge base for pain assessment and interventions.

Pain Physiology

Anxiolysis: Sedation or hypnosis used to reduce anxiety, agitation, or tension.

Neuropathic pain: Pain that arises from a damaged nerve.

Nociception: The process of pain transmission; usually relating to a receptive neuron for painful sensations.

Pain: An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.

Pain threshold level: The level of intensity at which pain becomes appreciable or perceptible.

Nonpharmacologic Management

Acupuncture: The piercing of specific body sites with needles to produce pain relief.

Counterirritant: An agent that is applied to produce irritation at one site so as to decrease perception of pain at the same or a distant site.

Cryoanalgesia: The destruction of peripheral nerves by extreme cold to achieve prolonged pain relief.

Cryotherapy: The therapeutic use of cold to reduce discomfort, limit progression of tissue edema, or break a cycle of muscle spasm.

Patient education: Providing the patient with an explanation of perioperative procedures, expected postoperative sensations, and instruction to help decrease mobility-related discomfort.

Relaxation methods: A variety of techniques to help decrease anxiety and muscle tension; these may include imagery, distraction, and progressive muscle relaxation.

Tactile strategies: Strategies that provide comfort through the sense of touch, such as stroking or massage.

TENS (transcutaneous electrical nerve stimulation): A method of producing electroanalgesia through electrodes applied to the skin.

Pain Assessment

Conscious sedation: "Light sedation" during which the patient retains airway reflexes and responses to verbal stimuli.

Oximetry: Determination of the oxygen saturation of arterial blood, typically by means of an external probe applied around a finger or toe.

Paradoxical reaction: A response (e.g., to a drug) that is the opposite of the usual response, such as agitation produced in a individual patient by a drug normally considered to be a sedative.

Pharmacologic Management

EMLA (eutectic mixture of local anesthetic): An ointment that contains local anesthetics so that topical application causes local anesthesia without the need for injection.

Epidural: Situated within the spinal canal, on or outside the dura mater (tough membrane surrounding the spinal cord); synonyms are "extradural" and "peridural."

Equianalgesic: Having equal pain killing effect; for example, morphine sulfate 10 mg intramuscular is generally used for opioid analgesic comparisons.

Interpleural: Situated between the membrane surrounding the lungs and the membrane lining the thoracic cavity.

Intrathecal: Within a sheath (e.g., cerebrospinal fluid that is contained within the dura mater).

Local nerve block: Infiltration of a local anesthetic around a peripheral nerve so as to produce anesthesia in the area supplied by the nerve.

Mixed opioid agonist-antagonist: A compound that has an affinity for two or more types of opioid receptors and blocks opioid effects on one receptor type while producing opioid effects on a second receptor type.

NSAID (nonsteroidal anti-inflammatory drug): Aspirin-like drug that reduces pain and inflammation arising from injured tissue.

Opioid agonist: Any morphine-like compound that produces bodily effects including pain relief, sedation, constipation, and respiratory depression.

Opioid partial agonist: A compound that has an affinity for and stimulates physiological activity at the same cell receptors as opioid agonists but that produces only a partial (i.e., submaximal) bodily response.

PCA (patient controlled analgesia): Self-administration of an analgesic by a patient instructed in doing so; usually refers to self-dosing with intravenous opioid (e.g., morphine) administered by means of a programmable pump.

Peridural: Synonym for "epidural" and "extradural."

Perineural: Surrounding a nerve.

References

Cook, T.D. & Campbell, D.T. (1979). *Quasi-experimentation: Design and analysis issues for field settings*. Chicago: Rand McNally College Publishing Co.

Field, M.D. & Lohr, K.N. (Eds.). (1990). *Clinical practice guidelines: Directions for a new program*. Committee to Advise the Public Health Service on Clinical Practice Guidelines, Institute of Medicine. Washington: National Academy Press.

International Association for the Study of Pain. (1979). Pain terms: A list with definitions and notes on usage. *Pain*, 6, 249.

Appendix A

Methods Used to Develop Clinical Practice Guideline

Methods Used to Develop Clinical Practice Guideline

Three processes were used for the development of the guideline. First was an extensive interdisciplinary clinical review of current needs, therapeutic practices and principles, and emerging technologies for postoperative pain control. This process included review of all pertinent guidelines and standards, receipt of information and opinion from external consultants, a commissioned paper on the ethical aspects of postoperative pain management, an open forum to receive input from concerned parties, and extensive discussion among the panel members.

The second process was a comprehensive review of published research on management of acute postoperative pain and, to a lesser extent, pain associated with trauma and procedure-induced pain. The panel determined that the review should include research related to pain assessment and both pharmacologic and nonpharmacologic treatments. The panel was particularly interested in the effects of the interventions on pain, complications, patient satisfaction, length of stay, and treatment costs.

Articles selected for review were (1) published empirical studies of pain in adults and children after elective and nonelective surgery, pain associated with diagnostic and treatment procedures, and pain associated with post-traumatic injuries and burns; (2) research based articles on measurement and assessment of pain; (3) pain management guidelines; and (4) review articles.

Articles excluded from review included: reports of animal studies and surgical interventions outside the scope of interventions accessible to specialized pain treatment teams or primary caregivers, studies of chronic benign or malignant pain except when also relevant to postoperative or procedural pain, studies comparing within-class analgesic potencies, descriptions of basic pain mechanisms except where specific clinical interventions were tested, editorials and commentaries, discussions of the etiology of pain, studies written in non-English languages, discussions of psychological characteristics, and pure dose-efficacy studies.

The literature review was done at sites in Boston (Harvard University and Massachusetts General Hospital), Baltimore (University of Maryland and The Johns Hopkins University), and Denver (University of Colorado). A group at the School of Public Health, Harvard University performed meta-analyses of drug and TENS studies. Nondrug studies were reviewed at the Baltimore and Denver sites.

The search strategy was developed in conjunction with the National Library of Medicine (NLM). Twelve databases were searched, producing a list of approximately 2,400 drug citations and 2,750 nondrug citations; additional citations were retrieved through other sources, for example another 4,314 nondrug and pain assessment citations and 42 drug citations were obtained from bibliographies of review articles, annotated bibliographies, and the like. From these, approximately 600 drug studies and 500 non-drug articles were reviewed

and coded for analysis. Using a best evidence synthesis, the research relevant to particular aspects of pain management was summarized and analyzed. Best-evidence synthesis is based on the best-evidence principle as used in law, in which the same evidence that would be essential in one case might be disregarded in another because better evidence is available (Slavin, 1986). When possible, meta-analyses were performed on the randomized controlled trials. The evidence used for recommendations regarding various interventions in adults is summarized in appendix B (Summary Table of Scientific Evidence for Interventions to Manage Pain in Adults). The table includes the intervention, the type of evidence, and comments regarding use of the intervention.

The third process was peer review of drafts of the guideline and pilot review with intended users. Thirty-three experts in various aspects of pain management reviewed and commented on an early draft of the guideline, using as a framework for their evaluation the attributes of clinical practice guidelines developed by the Institute of Medicine (IOM) of the National Academy of Sciences (Field and Lohr, 1990). Nine additional experts in pain management or practice guideline development reviewed a later draft, using the IOM attributes of guidelines and methods suggested by the Agency for Health Care Policy and Research (AHCPR). Nine additional experts in pain management in children reviewed the section of the guideline on neonates, infants, and children. Pilot review of a later draft was done with physicians, nurses, and others (n = 151) involved in pain management at 15 clinical sites. They reviewed and commented on the clarity, clinical applicability, flexibility, resources or training needed to implement the guideline, and cost implications of the guideline if implemented. A consumer version was developed and tested in clinical sites with 54 patients and 62 nurses and physicians, who reviewed it for clarity and accuracy.

Health policy issues related to ethical, economic, and legal aspects of postoperative pain management were addressed by the panel in several ways. A paper was commissioned on the ethical aspects of postoperative pain management, and the legal implications of pain management were addressed through the limited information available in the literature.

The entire process was anchored by an interdisciplinary panel of experts who used an integrated approach to synthesize the scientific evidence with the knowledge of experts to develop the guideline. Prior to printing of this guidance, drug dosage tables were reviewed by the U.S. Food and Drug Administration. The panel recommends that the guideline be updated 2 years after its publication.

References

Field, M.D. & Lohr, K.N. (Eds). (1990). *Clinical Practice Guidelines: Directions for a New Program.* Committee to Advise the Public Health Service on Clinical Practice Guidelines, Institute of Medicine. Washington: National Academy Press.

Slavin, R.E. (1986). Best-evidence synthesis: An alternative to meta-analytic and traditional reviews. *Educational Researcher*, 15, 5-11.

Appendix B

Summary Table of Scientific Evidence for Interventions to Manage Pain in Adults

B1. Pharmacologic Interventions

B2. Nonpharmacologic Interventions

B1. Pharmacologic Interventions

Intervention[1]		Type of Evidence[2]	Comments
NSAIDs	Oral (alone)	Ib, IV	Effective for mild to moderate pain. Begin preoperatively. Relatively contraindicated in patients with renal disease and risk of or actual coagulopathy. May mask fever.
	Oral (adjunct to opioid)	Ia, IV	Potentiating effect resulting in opioid sparing. Begin pre-op. Cautions as above.
	Parenteral (ketorolac)	Ib, IV	Effective for moderate to severe pain. Expensive. Useful where opioids contraindicated, especially to avoid respiratory depression and sedation. Advance to opioid.
Opioids	Oral	IV	As effective as parenteral in appropriate doses. Use as soon as oral medication tolerated. Route of choice.
	Intra-muscular	Ib, IV	Has been the standard parenteral route, but injections painful and absorption unreliable. Hence, avoid this route when possible.
	Sub-cutaneous	Ib, IV	Preferable to intramuscular when a low-volume continuous infusion is needed and intravenous access is difficult to maintain. Injections painful and absorption unreliable. Avoid this route for long-term repetitive dosing.
	Intravenous	Ib, IV	Parenteral route of choice after major surgery. Suitable for titrated bolus or continuous administration (including PCA), but requires monitoring. Significant risk of respiratory depression with inappropriate dosing.

Intervention[1]		Type of Evidence[2]	Comments
Opioids	PCA (systemic)	Ia, IV	Intravenous or subcutaneous routes recommended. Good steady level of analgesia. Popular with patients but requires special infusion pumps and staff education. See cautions about opioids above.
	Epidural & intrathecal	Ia, IV	When suitable, provides good analgesia. Significant risk of respiratory depression, sometimes delayed in onset. Requires careful monitoring. Use of infusion pumps requires additional equipment and staff education. Expensive if infusion pumps are employed.
Local anesthetics	Epidural & intrathecal	Ia, IV	Limited indications. Effective regional analgesia. Opioid sparing. Addition of opioid to local anesthetic may improve analgesia. Risks of hypotension, weakness, numbness. Requires careful monitoring. Use of infusion pump requires additional equipment and staff education.
	Peripheral nerve block	Ia, IV	Limited indications and duration of action. Effective regional analgesia. Opioid sparing.

[1] Selected references are included in this Clinical Practice Guideline. More complete references are available; see Acute Pain Management Guideline Panel. *Acute Pain Management: Operative or Medical Procedures and Trauma. Guideline Report.* AHCPR Pub. No. 92-0022. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services. In press.

[2] See type of evidence key following B2, page 107.

B2. Nonpharmacologic Interventions

Intervention[1]		Type of Evidence[2]	Comments
Simple relaxation (begin preoperatively)	Jaw relaxation Progressive muscle relaxation Simple imagery	Ia, IIa, IIb, IV	Effective in reducing mild to moderate pain and as an adjunct to analgesic drugs for severe pain. Use when patients express an interest in relaxation. Requires 3-5 minutes of staff time for instructions.
	Music	Ib, IIa, IV	Both patient-preferred and "easy listening" music are effective in reducing mild to moderate pain.
Complex relaxation (begin preoperatively)	Biofeedback	Ib, IIa, IIb, IV	Effective in reducing mild to moderate pain and operative site muscle tension. Requires skilled personnel and special equipment.
	Imagery	Ib, IIa, IV	Effective for reduction of mild to moderate pain. Requires skilled personnel.
Education/instruction (begin preoperatively)		Ia, IIa, IIb, IV	Effective for reduction of pain. Should include sensory and procedural information and instruction aimed at reducing activity related pain. Requires 5-15 minutes of staff time.
TENS		Ia, IIa, III, IV	Effective in reducing pain and improving physical function. Requires skilled personnel and special equipment. May be useful as an adjunct to drug therapy.

[1] Selected references are included in this Clinical Practice Guideline. For more complete references, see: Acute Pain Management Guideline Panel. *Acute Pain Management: Operative or Medical Procedures and Trauma. Guideline Report.* AHCPR Pub. No. 92-0022. Rockville, MD: Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services. In press.

[2] Insufficient scientific evidence is available to provide specific recommendations regarding the use of hypnosis, acupuncture, and other physical modalities for relief of postoperative pain.

Type of Evidence — Key

Ia Evidence obtained from meta-analysis of randomized controlled trials.

b Evidence obtained from at least one randomized controlled trial.

IIa Evidence obtained from at least one well-designed controlled study without randomization.

b Evidence obtained from at least one other type of well-designed quasi-experimental study.

III Evidence obtained from well-designed nonexperimental studies, such as comparative studies, correlational studies, and case studies.

IV Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

Appendix C

Dosage Tables for Adult and Pediatric Patients

C1. Dosing Data for NSAIDs

C2. Dosing Data for Opioid Analgesics

C1. Dosing Data for NSAIDs

Drug	Usual adult dose	Usual pediatric dose[1]	Comments
Oral NSAIDs			
Acetaminophen	650–975 mg q 4 hr	10–15 mg/kg q 4 hr	Acetaminophen lacks the peripheral anti-inflammatory activity of other NSAIDs
Aspirin	650–975 mg q 4 hr	10–15 mg/kg q 4 hr[2]	The standard against which other NSAIDs are compared. Inhibits platelet aggregation; may cause postoperative bleeding
Choline magnesium trisalicylate (Trilisate)	1000–1500 mg bid	25 mg/kg bid	May have minimal antiplatelet activity; also available as oral liquid
Diflunisal (Dolobid)	1000 mg initial dose followed by 500 mg q 12 hr		
Etodolac (Lodine)	200–400 mg q 6–8 hr		
Fenoprofen calcium (Nalfon)	200 mg q 4–6 hr		
Ibuprofen (Motrin, others)	400 mg q 4–6 hr	10 mg/kg q 6–8 hr	Available as several brand names and as generic; also available as oral suspension
Ketoprofen (Orudis)	25–75 mg q 6–8 hr		
Magnesium salicylate	650 mg q 4 hr		Many brands and generic forms available

Drug	Usual adult dose	Usual pediatric dose[1]	Comments
Oral NSAIDs			
Meclofenamate sodium (Meclomen)	50 mg q 4–6 hr		
Mefenamic acid (Ponstel)	250 mg q 6 hr		
Naproxen (Naprosyn)	500 mg initial dose followed by 250 mg q 6–8 hr	5 mg/kg q 12 hr	Also available as oral liquid
Naproxen sodium (Anaprox)	550 mg initial dose followed by 275 mg q 6–8 hr		
Salsalate (Disalcid, others)	500 mg q 4 hr		May have minimal antiplatelet activity
Sodium salicylate	325–650 mg q 3–4 hr		Available in generic form from several distributors
Parenteral NSAID			
Ketorolac	30 or 60 mg IM initial dose followed by 15 or 30 mg q 6 hr Oral dose following IM dosage: 10 mg q 6–8 hr		Intramuscular dose not to exceed 5 days

Note: Only the above NSAIDs have FDA approval for use as simple analgesics, but clinical experience has been gained with other drugs as well.

[1]Drug recommendations are limited to NSAIDs where pediatric dosing experience is available.

[2]Contraindicated in presence of fever or other evidence of viral illness.

C2. Dosing Data for Opioid Analgesics

Drug	Approximate equianalgesic oral dose	Approximate equianalgesic parenteral dose
Opioid Agonist		
Morphine[2]	30 mg q 3–4 hr (around-the-clock dosing)	10 mg q 3–4 hr
	60 mg q 3–4 hr (single dose or intermittent dosing)	
Codeine[3]	130 mg q 3–4 hr	75 mg q 3–4 hr
Hydromophone[2] (Dilaudid)	7.5 mg q 3–4 hr	1.5 mg q 3–4 hr
Hydrocodone (in Lorcet, Lortab, Vicodin, others)	30 mg q 3–4 hr	Not available
Levorphanol (Levo-Dromoran)	4 mg q 6–8 hr	2 mg q 6–8 hr
Meperidine (Demerol)	300 mg q 2–3 hr	100 mg q 3 hr
Methadone (Dolophine, others)	20 mg q 6–8 hr	10 mg q 6–8 hr
Oxycodone (Roxicodone, also in Percocet, Percodan, Tylox, others)	30 mg q 3–4 hr	Not available
Oxymorphone[2] (Numorphan)	Not available	1 mg q 3–4 hr
Opioid Agonist-Antagonist and Partial Agonist		
Buprenorphine (Buprenex)	Not available	0.3–0.4 mg q 6–8 hr
Butorphanol (Stadol)	Not available	2 mg q 3–4 hr
Nalbuphine (Nubain)	Not available	10 mg q 3–4 hr
Pentazocine (Talwin, others)	150 mg q 3–4 hr	60 mg q 3–4 hr

Note: Published tables vary in the suggested doses that are equianalgesic to morphine. Clinical response is the criterion that must be applied for each patient; titration to clinical response is necessary. Because there is not complete cross tolerance among these drugs, it is usually necessary to use a lower than equianalgesic dose when changing drugs and to retitrate to response.

Caution: Recommended doses do not apply to patients with renal or hepatic insufficiency or other conditions affecting drug metabolism and kinetics.

[1] **Caution:** Doses listed for patients with body weight less than 50 kg cannot be used as initial starting doses in babies less than 6 months of age. Consult the *Clinical Practice Guideline for Acute Pain Management: Operative or Medical Procedures and Trauma* section on management of pain in neonates for recommendations.

Recommended starting dose (adults more than 50 kg body weight) oral	parenteral	Recommended starting dose (children and adults less than 50 kg body weight)[1] oral	parenteral
30 mg q 3–4 hr	10 mg q 3–4 hr	0.3 mg/kg q 3–4 hr	0.1 mg/kg q 3–4 hr
60 mg q 3–4 hr	60 mg q 2 hr (intramuscular/ subcutaneous)	1 mg/kg q 3–4 hr[4]	Not recommended
6 mg q 3–4 hr	1.5 mg q 3–4 hr	0.06 mg/kg q 3–4 hr	0.015 mg/kg q 3–4 hr
10 mg q 3–4 hr	Not available	0.2 mg/kg q 3–4 hr[4]	Not available
4 mg q 6–8 hr	2 mg q 6–8 hr	0.04 mg/kg q 6–8 hr	0.02 mg/kg q 6–8 hr
Not recommended	100 mg q 3 hr	Not recommended	0.75 mg/kg q 2–3 hr
20 mg q 6–8 hr	10 mg q 6–8 hr	0.2 mg/kg q 6–8 hr	0.1 mg/kg q 6–8 hr
10 mg q 3–4 hr	Not available	0.2 mg/kg q 3–4 hr[4]	Not available
Not available	1 mg q 3-4 hr	Not recommended	Not recommended
Not available	0.4 mg q 6–8 hr	Not available	0.004 mg/kg q 6–8 hr
Not available	2 mg q 3–4 hr	Not available	Not recommended
Not available	10 mg q 3–4 hr	Not available	0.1 mg/kg q 3–4 hr
50 mg q 4–6 hr	Not recommended	Not recommended	Not recommended

[2]For morphine, hydromorphone, and oxymorphone, rectal administration is an alternate route for patients unable to take oral medications, but equianalgesic doses may differ from oral and parenteral doses because of pharmacokinetic differences.

[3]**Caution:** Codeine doses above 65 mg often are not appropriate due to diminishing incremental analgesia with increasing doses but continually increasing constipation and other side effects.

[4]**Caution:** Doses of aspirin and acetaminophen in combination opioid/NSAID preparations must also be adjusted to the patient's body weight.

Appendix D

Methods for Pain Assessment

D1. Examples of Pain Intensity and Pain Distress Scales

D2. Initial Pain Assessment Tool

D3. Flow Sheet—Pain

D4. Pain History for Pediatric Patients

D5. Poker Chip Tool Instructions

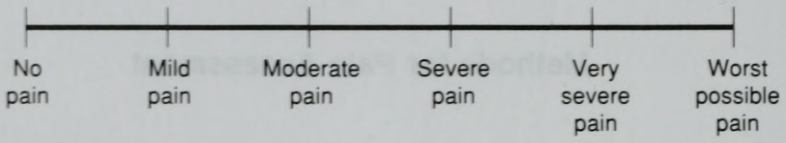
D6. Word-Graphic Rating Scale

D7. Pain Interview for Pediatric Patients

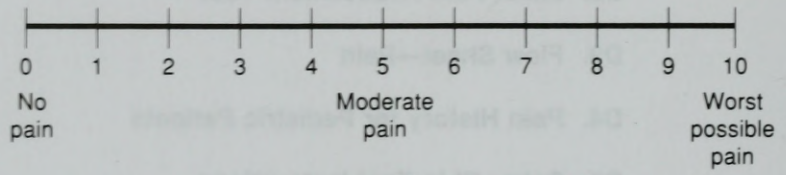
D1. Examples of Pain Intensity and Pain Distress Scales

Pain Intensity Scales

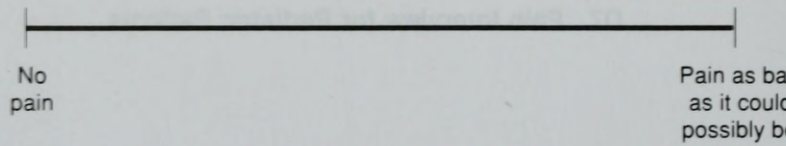
Simple Descriptive Pain Intensity Scale*



0 - 10 Numeric Pain Intensity Scale*



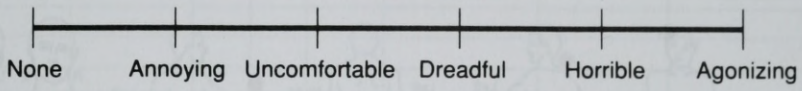
Visual Analog Scale (VAS)**



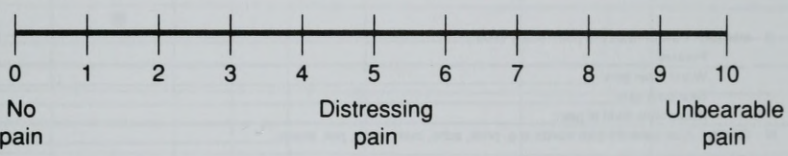
*If used as a graphic rating scale, a 10-cm baseline is recommended.
**A 10-cm baseline is recommended for VAS scales.

Pain Distress Scales

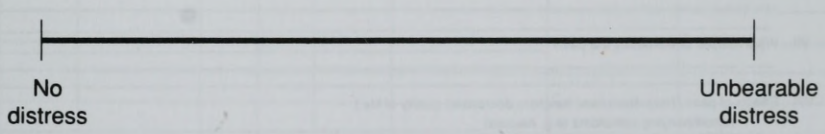
Simple Descriptive Pain Distress Scale*



0 - 10 Numeric Pain Distress Scale*



Visual Analog Scale (VAS)**



*If used as a graphic rating scale, a 10-cm baseline is recommended.
**A 10-cm baseline is recommended for VAS scales.

D2. Initial Pain Assessment Tool

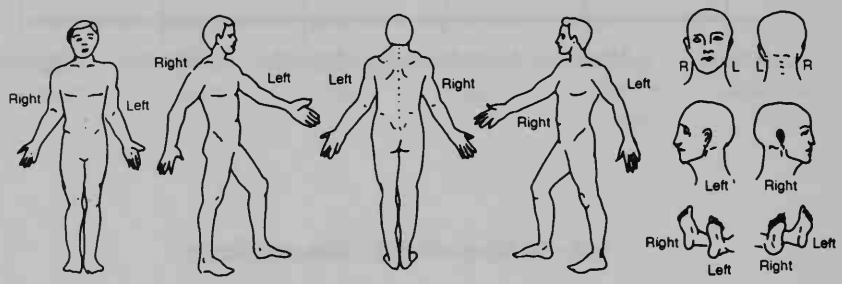
Date _____

Patient's Name _____ Age _____ Room _____

Diagnosis _____ Physician _____

Nurse _____

I. Location: Patient or nurse mark drawing.



II. Intensity: Patient rates the pain. Scale used _____
- Present: _____
- Worst pain gets: _____
- Best pain gets: _____
- Acceptable level of pain: _____

III. Quality: (Use patient's own words, e.g. prick, ache, burn, throb, pull, sharp) _____

IV. Onset, duration variations, rhythms: _____

V. Manner of expressing pain: _____

VI. What relieves the pain? _____

VII. What causes or increases the pain? _____

VIII. Effects of pain: (Note decreased function, decreased quality of life.)
- Accompanying symptoms (e.g. nausea) _____
- Sleep _____
- Appetite _____
- Physical activity _____
- Relationship with others (e.g. irritability) _____
- Emotions (e.g. anger, suicidal, crying) _____
- Concentration _____
- Other _____

IX. Other comments: _____

X. Plan: _____

■ May be duplicated for use in clinical practice. Used with permission from McCaffery, M. and Beebe, A. *Pain: Clinical Manual for Nursing Practice* (1989), St. Louis: C.V. Mosby.

D3. Flow Sheet—Pain

Patient _____ Date _____

* Pain rating scale used _____

Purpose: to evaluate the safety and effectiveness of the analgesic(s).

Analgesic(s) prescribed: _____

Time	Pain rating	Analgesic	R	P	BP	Level of arousal	Other†	Plan & comments

* *Pain rating*: A number of different scales may be used. Indicate which scale is used and use the same one each time. For example, 0-10 (0= no pain, 10 = worst pain).

† *Possibilities for other columns*: bowel function, activities, nausea and vomiting, other pain relief measures. Identify the side effects of greatest concern to patient, family, physician, and nurses.

■ May be duplicated for use in clinical practice. Used with permission from McCaffery, M. and Beebe, A. *Pain: Clinical Manual for Nursing Practice* (1989), St. Louis: C.V. Mosby.

D4. Pain History for Pediatric Patients

Pain Experience History	
Child Form	**Parent Form**
Tell me what pain is.	What word(s) does your child use in regard to pain?
Tell me about the hurt you have had before.	Describe the pain experiences your child has had before.
Do you tell others when you hurt? If yes, who?	Does your child tell you or others when he/she is hurting?
What do you do for yourself when you are hurting?	How do you know when your child is in pain?
What do you want others to do for you when you hurt?	How does your child usually react to pain?
What don't you want others to do for you when you hurt?	What do you do for your child when he/she is hurting?
What helps the most to take your hurt away?	What does your child do for him/herself when he/she is hurting?
Is there anything special that you want me to know about you when you hurt? (If yes, have child describe.)	What works best to decrease or take away your child's pain?
	Is there anything special that you would like me to know about your child and pain? (If yes, describe)

Adapted with permission from Hester, N.O. & Barcus, C.S. (1986). Assessment and management of pain in children. *Pediatrics: Nursing Update* [Continuing Professional Education Center, Inc., Princeton, NJ], 1, 2-8.

D5. Poker Chip Tool Instructions

English Instructions

1. Use four red poker chips.
2. Align the chips horizontally in front of the child on the bedside table, a clipboard or other firm surface.
3. Tell the child, *"These are pieces of hurt."* Beginning at the chip nearest the child's left side and ending at the one nearest the right side, point to the chips and say. *"This* (the first chip) *is a little bit of hurt and this* (the fourth chip) *is the most hurt you could ever have."*

For a young child or for any child who does not comprehend the instructions, clarify by saying, *"That means this* (the first chip) *is just a little hurt; this* (the second chip) *is a little more hurt; this* (the third chip) *is more hurt; and this* (the fourth chip) *is the most hurt you could ever have."*

4. Ask the child, *"How many pieces of hurt do you have right now?"* Children without pain will say they don't have any.
5. Clarify the child's answer by words such as "Oh, you have a little hurt? Tell me about the hurt." (Use the Pain Interview.)
6. Record the number of chips selected on the bedside flowsheet.

Spanish Instructions

1. Follow the English instructions, substituting the following words.
2. Tell the parent, if present: *"Estas fichas son una manera de medir dolor. Usamos cuatro fichas."*
3. Say to the child: *"Estas son pedazos de dolor: una es un poquito de dolor y cuatro son el dolor maximo que tu puedes sentir. Cuantos pedazos de dolor tienes?"*

Developed in 1975 by Nancy O. Hester, University of Colorado Health Sciences Center, Denver, CO.

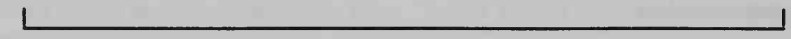
Spanish instructions by Jordan-Marsh, M., Hall, D., Yoder, L. Watson, R., McFarlane-Sosa, G., & Garcia, M. (1990). *The Harbor-UCLA Medical Center Humor Project for Children.* Los Angeles: Harbor-UCLA Medical Center.

D6. Word-Graphic Rating Scale

Instructions

"This is a line with words to describe how much pain you may have. This side of the line means no pain and over here the line means worst possible pain." (Point with your finger where "no pain" is, and run your finger along the line to "worst possible pain," as you say it.) *"If you have no pain, you would mark like this."* (Show example.) *"If you have some pain, you would mark somewhere along the line, depending on how much pain you have."* (Show example.) *"The more pain you have, the closer to worst pain you would mark. The worst pain possible is marked like this."* (Show example.)

"Show me how much pain you have right now by marking with a straight, up and down line anywhere along the line to show how much pain you have right now."



No Pain	Little Pain	Medium Pain	Large Pain	Worst Possible Pain

Reprinted with permission from Savedra, M.C., Tesler, M.D., Holzemer, W.L., & Ward, J.A. (1989). *Adolescent pediatric pain tool (APPT) preliminary user's manual.* San Francisco: University of California.

D7. Pain Interview for Pediatric Patients

Pain Interview	
Child Form	**Parent Form**
Tell me about the hurt you're having now.	Tell me about the pain your child is having now.
Elicit descriptors, location, and cause.	Elicit descriptors, location, and cause.
What would you like me to do for you?	What would you like me to do for your child?

Adapted with permission from Hester, N.O. & Barcus, C.S. (1986). Assessment and management of pain in children. *Pediatrics: Nursing Update* [Continuing Professional Education Center, Inc., Princeton, NJ], 1, 2-8.

Appendix E

Relaxation Exercises

Relaxation Exercises

Example 1: Deep Breath/Tense, Exhale/Relax, Yawn for Quick Relaxation

1. Clench your fists; breathe in deeply and hold it a moment.
2. Breathe out slowly and go limp as a rag doll.
3. Start yawning.

Additional points: Yawning becomes spontaneous. It is also contagious, so others may begin yawning and relaxing too.

Example 2: Slow Rhythmic Breathing for Relaxation

1. Breathe in slowly and deeply.
2. As you breathe out slowly, feel yourself beginning to relax; feel the tension leaving your body.
3. Now breathe in and out slowly and regularly, at whatever rate is comfortable for you. You may wish to try abdominal breathing. If you do not know how to do abdominal breathing, ask your nurse for help.
4. To help you focus on your breathing and breathe slowly and rhythmically: Breathe in as you say silently to yourself, "in, two, three." Breathe out as you say silently to yourself, "out, two, three," *or* each time you breathe out, say silently to yourself a word such as peace or relax.
5. You may imagine that you are doing this in a place you have found very calming and relaxing for you, such as lying in the sun at the beach.
6. Do steps 1 through 4 only once or repeat steps 3 and 4 for up to 20 minutes.
7. End with a slow deep breath. As you breathe out say to yourself "I feel alert and relaxed."

Additional points: If you intend to do this for more than a few seconds, try to get in a comfortable position in a quiet environment, you may close your eyes or focus on an object. This technique has the advantage of being very adaptable in that it may be used for only a few seconds or for up to 20 minutes.

Example 3: Peaceful Past

Something may have happened to you a while ago that brought you peace and comfort. You may be able to draw on that past experience to bring you peace or comfort now. Think about these questions:

1. Can you remember any situation, even when you were a child, when you felt calm, peaceful, secure, hopeful, comfortable?
2. Have you ever daydreamed about something peaceful? What were you thinking of?
3. Do you get a dreamy feeling when you listen to music? Do you have any favorite music?
4. Do you have any favorite poetry that you find uplifting or reassuring?
5. Have you ever been religiously active? Do you have favorite readings, hymns, or prayers? Even if you haven't heard or thought of them for many years, childhood religious experiences may still be very soothing.

Additional points: Very likely some of the things you think of in answer to these questions can be recorded for you, such as your favorite music or a prayer. Then you can listen to the tape whenever you wish. Or, if your memory is strong, you may simply close your eyes and recall the events or words.

Adapted with permission from McCaffery, M. & Beebe, A. (1989). *Pain: Clinical manual for nursing practice*. St. Louis: CV Mosby.

Appendix F

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F1. Acute Pain Management Guideline Panel: Biosketches

F2. Acute Pain Management Guideline Peer Reviewers, Consultants, and Contributors

F3. Acute Pain Management Guideline Site Review Coordinators

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